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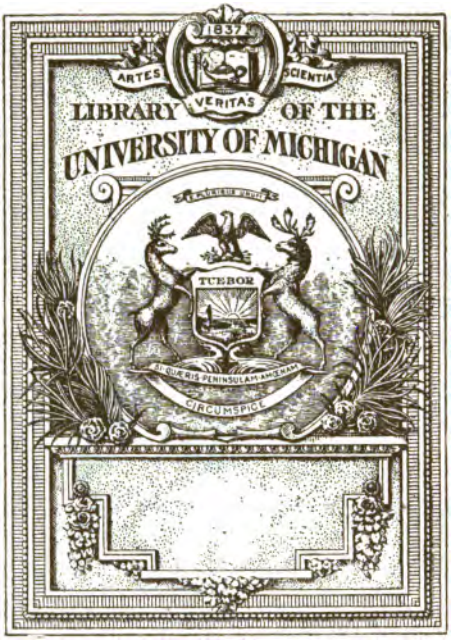
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RETROSPECT

OF

PHILOSOPHICAL, MECHANICAL,
CHEMICAL, and AGRICULTURAL

DISCOVERIES;

BEING AN

ABRIDGMENT

OF THE

PERIODICAL AND OTHER PUBLICATIONS,
ENGLISH AND FOREIGN,

RELATIVE TO

ARTS, CHEMISTRY, MANUFACTURES, AGRICULTURE,
AND NATURAL PHILOSOPHY;

ACCOMPANIED, OCCASIONALLY, WITH

REMARKS ON THE MERITS AND DEFECTS OF THE
RESPECTIVE PAPERS;

AND, IN SOME CASES,

SHEWING TO WHAT OTHER USEFUL PURPOSES INVENTIONS
MAY BE DIRECTED, AND DISCOVERIES EXTENDED,
BEYOND THE ORIGINAL VIEWS OF THEIR AUTHORS.

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RETROSPECT

OF

PHILOSOPHICAL, MECHANICAL, CHEMICAL AND AGRICULTURAL DISCOVERIES.

No. XXXII.] { *January, February, March, April, May, June.* } [1812.

REVIEW OF SPECIFICATIONS OF PATENTS,

PUBLISHED IN THE REPERTORY OF ARTS, MANUFACTURES, &c.

During the Months of Jan: Feb. March, April, May, June.

Patent of THOMAS WILLIAM STURGEON, *Esq. of Howland-street, Middlesex, for Improved Castors. Dated March,* 1811. *—Repertory of Arts, No.* 116, *Second Series.*

THESE improved castors, instead of the wheels used in other castors, move each on a revolving ball or spherical piece, which is made to have sufficient freedom of motion, by having three or more friction-rollers interposed between it and the weight it is to sustain, while it is retained in its place by a hollow piece of metal, that only touches it when the whole is raised from the ground, and admits of about one-third of the circumference of the ball to project beyond its lower surface. The friction-rollers are fixed so that their planes may pass through the centre of the ball, and that their points of contact with the ball may be at about 120 degrees, measured on its surface, above the point where it rests on the floor. The patentee prefers the use of six of these friction-rollers; and, as one example of their proportions to the ball, states, that for a ball one inch in diameter, six friction-rollers, each one-third of an inch in diameter,

may be used, disposed in the same horizontal plane, so that the lines joining the pivots of the rollers shall form the sides of a hexagon, circumscribing a circle of an inch and a quarter in diameter; and mentions, that the ball will then be duly disposed to roll in any direction, and will perfectly perform the office of a castor.

The dimensions and relative positions of the several parts of this castor, will admit of considerable variation; but what they ought to be, so as to produce the effect intended, may be easily conceived for each occasion, from the description given by the patentee.

Observations.—Mr. Sturgeon's castors seem to be much superior in their construction to any in common use, and appear to want only to be known in order to be universally adopted. They will be entirely free from the inequality of bearing, which causes common castors to resist a change of position; and as they are capable of motion with equal facility in every direction, the disagreeable hitching, which so frequently occurs with common castors, can never take place with them.

Patent of* GEORGE HODSON, *of Edinburgh, Ash-Manufacturer, for a Method of separating the Alkaline Salt from the Acid, as it exists in Kelp, Black Ashes, Soapers' Salts, Spent Leys, Soda, Natron, Rock Salt, Common Salt, Brine, Sea Water, Caput Mortuum of Aquafortis, Caput Mortuum of Oil of Vitriol, and Caput Mortuum of Salt used by Bleachers. Dated October,* 1810.—*Repertory of Arts, No.* 117, *Second Series.

THE following processes are stated by the patentee to be used for the purposes mentioned in the title of his patent.—A ton of kelp is ground to the size of a walnut, and introduced into a vat or vats, with receivers under them, such as soap-boilers use. Water is then added, so as completely to cover it: after standing in that state twelve hours, the plug at the bottom is partially taken out, and the saline fluid drawn off in the usual manner soap-boilers follow. One hundred and sixty gallons of the first running are to be reserved, in order to mix with the remainder of the saline matter, to make the whole obtained of equal strength when it is introduced into the evaporating pan. The kelp in the vat should be covered with water, which should be kept running until the saline matter be wholly obtained. This saline matter is to be put into evaporating pans of a certain form, rather oval, each containing two hundred gallons more or less: five hundred weight of well-burnt lime, slaked and reduced to powder, and then immersed in water, in order that the stones and gravel may subside, must be added to the

saline matter in proper proportions, to take in the whole of the saline matter, as it is introduced into the evaporating pans. Five hundred weight of charcoal, or cinders, or pit-coal, ground to dust, and afterwards put through a fine sieve, is also introduced into the evaporating pans, in proper proportions, along with the lime, and ten pounds of vegetable alkali, more or less, equally divided between the pans, which will accelerate the process. A strong fire is to be put under the pan, care being always taken that the fire is placed at a proper distance from the pan; and constant stirring must be employed until the lixivium begins to rise, which it will do in a similar manner to soap when boiling, and it must be treated by cooling as soap is, otherwise it will overflow the top of the pan. As the liquid evaporates, soft water must be added until the acid is dispersed, which will be effected in proportion to the quantity of saline matter in the pan with kelp of medium quality. The operation is finished in twelve or fourteen hours. Care must be taken not to fill the pan too full, in order to give the fluid liberty to rise. Care must also be taken frequently to stir the bottom of the pan with an iron stirrer, made in length in proportion to the depth of the pan. When the acid is found to be evaporated, which may be known by a simple chemical process upon a tea-cup full of the fluid in the pan, the fire must be partially drawn, and kept moderate, until the moisture is wholly evaporated. The fire must then be removed, and the substance in the pan stirred until it is cool, so as to prevent its adhering to the bottom of the pan. This substance is now in a state fit to be used by the soap-makers, in the same way they use other ashes, by bruising it small, and mixing it with quick lime, properly slaked. If a manufactory for preparing the ash for sale should be established, the substance must be put into a reverberating furnace, and such heat applied as to render it fluid; in which state it may be kept half an hour with a moderate fire. During the half hour when fluid, it is to be frequently stirred with an iron rake, made for the purpose. It may be stirred in the dry state a few times before it becomes fluid. It is drawn out of the furnace, in a fluid state, into an iron pot, placed under the door of the furnace. When cool, it comes out of the pot in a solid mass, similar in appearance to barilla.

The same mode of procedure must be followed with all the other substances in the patent. Those of them which contain earth in a state of combination, as the kelp does, must be bruised quite small, and dissolved in soft water; common salt must also be dissolved.

Another part of the process is to be conducted in a reverberating furnace; the kelp is to be bruised as the soap-makers now grind it for use, and five or six hundred weight of it is to be introduced into the furnace, along with two hundred weight of black peat moss, or earth, or moss made small, and moistened with water; fire is to be applied, and with a proper iron rake it is to be stirred frequently,

until the peat moss is consumed, which will be in six or eight hours; it is then to be drawn out, and is fit for use. All the other substances in the patent must be treated in the same manner.

Observations.—The first process detailed by Mr. Hodson for separating alkalies from acids, in the salts in which they are united, would lead an inexperienced person to suppose that this was an operation of great facility; for he actually talks of its being effected before the application of the reverberating furnace; but we fancy those who would try it, would not find it quite so easy as they might suppose. The addition of the lime, in the slaked state mentioned, in conjunction with charcoal, does not seem likely to be of any service in the process, the only effectual ingredient in which, appears to be the vegetable alkali; and even that is directed to be used in a proportion much too small, to have any considerable effect on several of the salts mentioned.

The second process which is directed to succeed the first, is the most likely to be effectual, and appears to contain the only point of novelty in the specification; which is, the use of peat moss with the salts in the reverberating furnace. Some species of turf or peat (as that of Tingrith Moor) contains sulphate of iron, which along with the carbonaceous matter of the peat, would convert some of the salts mentioned into sulphurets; which the continuation of the action of the reverberating furnace would ultimately reduce to their respective alkalies. In several situations also, the use of peat would be a very cheap method of supplying the carbonaceous matter wanted for the reduction of the salts; and therefore, in either point of view, its introduction appears the most valuable part of the patent: but as the patentee has not secured the right of the use of it for all sulphates, since he has not given any directions for the previous reduction of any of the salts mentioned to the state of sulphates, one of the most valuable applications of the use of peat in the production of alkalies, appears to be left open to the free use of the public; which is the reduction by its means of sulphates in the manner stated; to which state all the salts mentioned, not of this description, might be brought by either the direct use of sulphuric acid, or by treating them in a proper manner with some other salt containing this acid in a weaker state of combination, than that which would be formed with it by the alkalies contained in the salts.

As the specification is rather expressed in obscure terms, we have given it in the exact words of the patentee, lest any mistake should occur in attempting to reduce it to a more perspicuous form.

Patent of Mr.* JOHN CRAIGIE *of Quebec, now residing in Craven-street, Middlesex, for Improvements in Waggons, and other Wheel-Carriages. Dated March,* 1811.—*Repertory of Arts, No.* 116, *Second Series.

MR. CRAIGIE'S improvement in wheel-carriages relates to the mode of suspending their bodies; this he effects by fixing to the frame a bar lengthwise at each side of the waggon, and about two inches distant from the body, and suspending the latter from these bars by braces about eight inches in length; the number, strength, and materials of which braces may be varied, according to the nature of the load.

This method can also be applied to two-wheeled carriages; and the patentee asserts that it is superior to springs in cheapness, safety, durability, and the extent of weight to which it can be applied; that it saves friction, and diminishes labour, and also prevents that shifting of the position of the centre of gravity of the load, in ascending and descending hills, which in other carriages is found to be injurious to the power of the horse.

Observations.—The use of slings for carriages was more ancient than that of springs; but the superiority of the latter has been found so evident, as to have in many instances superceded slings altogether; and in carriages for pleasure they are now never used but in conjunction with springs. A few light waggons may, however, be still seen in London, in which slings are used, both in the old way, from uprights before and behind them, and also from uprights at the sides, so as to have precisely the same action as those proposed by the patentee. As these facts are universally known, it is difficult to conceive what could be the motive of the patentee for expending money on such untenable and unproductive matters, as those embraced by this patent.

The whole of the assertions of the patentee in favour of his plan, are founded on error, for springs are demonstrably superior to slings in mechanical effect, on account of their re-action, which, when they are properly placed, restores the motion that the percussion, caused by casual obstacles, would otherwise destroy. Slings possess no power whatever in preventing the receding of the centre of gravity of a load in going up-hill, but, on the contrary, can be proved to have the opposite effect; and so far from springs being deficient in strength, we are convinced from numerous facts, that they may be made fully adequate to any load; and that their not being universally adopted for all waggons, is caused by ignorance and obstinacy chiefly of the drivers, to which proprietors often prefer to submit, rather than have the trouble of contending with them.

Patent of Mr. WILLIAM GOOD, *of Coleman-street, London, Plumber, for an Improvement in Valves for various purposes. Dated September,* 1811.—*Repertory of Arts, No.* 116, *Second Series.*

THE application of Mr. Good's improvement in valves, first described in the specification, is that proper for cocks used for common purposes. The hollow body of the cock is composed of two pieces, one placed horizontally, which enters the vessel for which it is wanted, and the other vertically, and screwed into the lower part of the outward extremity of the former; in this vertical part the valve is placed, which is a common flat valve of metal, with a tail depending from its centre, which tail is perforated up to the valve, to receive a thick wire that rises from the side of the hollow body, and which serves to keep it steady when moved upwards by a trigger, or small lever used for this purpose, which projects from the side of a small axis that passes through the side of the vertical part of the cock, where the handle is joined to it by which it is moved; the end of the trigger is forked in order to admit the wire guide of the valve, as it raises up its tail; the joints of the axis are made sufficiently tight to prevent the liquor from entering between them; and the horizontal barrel of the cock has above the head of the valve, a hollow formed in it for the reception of the valve, so as to prevent its causing any obstruction to the passage of the liquor.

Mr. Good states, that the same arrangement may be made to succeed for a horizontal waterway, or when it might be convenient to have the axis of the handle in an upright position, by having a spring placed so as to press the valve close against its bed when the trigger is withdrawn; and that the cock may be made to remain permanently open, or shut as desired, by making the axis more stiff by means of a binding spring or other method; and that a floating ball may be made to have the same action in opening or shutting this valve, as it has in a common ball cock, and that it will have this effect with greater speed and certainty.

Observations.—Valves have been used in the bodies of cocks, in place of the common perforated turning pieces, long before the date of Mr. Good's patent; and Mr. Bramah has had a patent for several ingenious applications of this principle. It is therefore in the mode of moving the valve, and in the arrangement of the apparatus, that the novelty of Mr. Good's plan consists; and it appears commendable, both in being more simple, and more easily kept clean than those valve-cocks which require stuffing-boxes, or leather collars to the rods, which move the valves; and also from

the facility it affords of repair, in case of accident, from the part of the cock which contains the valve and trigger, &c. being made to unscrew from the rest in such a manner, as to afford a clear view of the apparatus. This valve-cock also requires little force in opening it, and is easily kept from leaking; in which it has the advantage over common cocks, which are liable to leak when they move freely; and often move so stiffly when secured from that accident, as to endanger their extraction from the casks, and consequent waste of the liquor by the force necessary in turning their handles.

Patent of Mr. RALPH SUTTON, *of Birmingham, Brass-Founder, for an improved Self-acting Curtain, or Window-blind Rack. Dated July,* 1811.—*Repertory of Arts, No.* 116, *Second Series.*

MR. SUTTON's invention consists of a spiral spring inclosed in a small tube; this spring presses down a thick wire, to which is attached a pulley, round which an endless band or cord passes, that gives motion to the roller that sustains the window-blind, by passing round a similar pulley fastened to it at one end. The action of the spring causes the cord to be pulled down tight, by which the friction on the axis of the roller which sustains the blind, is so much increased, that the weight of the blind cannot cause it to turn, and consequently the blind will remain suspended in any position in which it is thought proper to leave it.

Two methods are described in the specification, for fixing the pulleys at the spring tubes; in one the wire or small bar, to which the pulley is fastened, rises above the tube, and the pulley is consequently placed above the tube; in the other method the pulley lies within the tube at its lower extremity. The first method is preferred by the patentee; because the cord can be adjusted to its pulley, or removed from it, without being severed, and the tube may be made to cover the spring entirely without having any openings in it; by which means the spring will be more effectually secured from accidents. The tubes may be of brass or other metal, and may be ornamented as fancy directs.

Observations.—A very simple method of giving the roller of a window-blind the friction necessary to sustain it in any position required, is now effected by a flat horizontal spring above it, which draws it up so as to press against the upper part of the frame when at rest, and yields sufficiently, when the blind is drawn down, to release it from all pressure. This method is also the object of a patent, and seems preferable to that above-recited, on account of its greater simplicity and strength, and consequent less liability to de-

rangement. At the same time it should be noticed, that the method contained in the above patent, though inferior to the other, is however a very good one, and will be effectual as long as the spiral spring retains strength sufficient to give the axis of the roller the friction required.

Patent of Mr. JOHN COLLINGE, *of Bridge-road, Lambeth, Surrey, Axletree Manufacturer, for certain Improvements in Carriages, and in Boxes and Axletrees. Dated March,* 1811.—*Repertory of Arts, No.* 117, *Second Series.*

THE specification of this patent contains a description of an arrangement of the wheel-box and axle, the chief novelty of which is a part of the box at the outward extremity, being formed of a smaller diameter than the rest, which narrow part the patentee calls a bridge, and the outer end of the axle being made smaller than the rest to fit to this narrow part of the box; the thicker part of the axle forms a shoulder, against which this narrow part of the box lies, and is thus prevented from passing farther in on the axle. On the small part of the axle which projects beyond the bridge, or narrow part of the box, a collar is fitted, which extends from the bridge to the linch-pin, and forms a bearing against the outward part of the bridge, that prevents the box from being drawn off the axle until it is removed. The linch-pin passes through the axle, outside this collar, and has a ring through its upper part, which falls over the end of the axle, and prevents it from rising or getting out of its place; for farther security to diminish the chance of the linch-pin being broken, it is made in two or more flat pieces rivetted together. Over the linch-pin and collar, a hollow cap is screwed to a part of the end of the box, which projects beyond the bridge, and has an inside screw formed in it to receive the corresponding screw made to enter it at the end of the cap. This cap prevents the ring of the linch-pin from moving from its place, keeps the linch-pin from getting out independent of the ring, forms a handsome termination to the nave, and at the same time serves as a box for holding oil for the axle; to admit which oil, a small perforation is made in its centre that is closed up with a screw, when the oil is inserted.

The part of the axle that holds the collar may be flatted, or made polygonal, in order to prevent its turning round, and washers may be placed at both sides of the bridge, to diminish its friction, both against the collar and against the shoulder formed by the thicker part of the axle.

At the internal end of the box a circular cavity is made to hold oil, from which a passage is made to the external cap, by a groove or otherwise, along the box and through the bridge, so as to admit

a free passage for the oil throughout; and a similar circular cavity, but of a smaller size, is made for the same purpose, just behind the bridge.

The whole of the internal end of the box and nave is inclosed in a metal case, called by the patentee a *cuttoe*, fastened to the axle, which prevents dirt or water from getting in between the axle and the box.

The patentee recommends the axle to be made of wrought-iron case-hardened, and the box to be made of cast-iron case-hardened; and states, that the bridge at the outward end of the box, bearing both ways, may be made with divers variations, particularly with regard to the fastening at the linch end, which may be effected by one or more screw-nuts, with or without a linch-pin; and mentions, that a flat piece of leather may be applied to the body-end of the box, for the better exclusion of wet and dirt; but that neither it, nor any other part of the box, except the bridge, is to be placed so as to have any friction endwise.

Observations.—The only novelty in this mode of arranging the wheel-box and axle, is the bridge, or contracted part of the box; of which the chief advantage is in its confining the friction endways to a part, remote from risk of any sand or gravel getting at it by the action of the wheel. The whole combination is however well calculated to give security against the separation of the box from the axle, by the linch-pin coming out; to preserve the parts in motion from dirt; and to relieve the friction, by a proper distribution of oil on all the parts that come in contact during the motion of the wheel.

Patent of* JOSEPH BASTONE, *of Bridgwater, Somersetshire, Cabinet-maker, for Improvements applicable to Bedsteads, and to various other Things. Dated July, 1811.—Repertory of Arts, No. 117, Second Series.

MR. BASTONE's improvement is a metal joint separable in two pieces, each of which is capable of being attached firmly by screws to the corresponding parts of the frame of a bedstead, or other frame; by which means the parts of the frame are easily and speedily united or separated as desired, without the assistance of a workman.

The part of the joint, which is intended to fit to a horizontal part of a frame, is formed of an upright plate with a tenon descending from its lower part, a square mortise hole in its upper part, and a piece projecting at right angles from each side of its back, perforated with screw-holes, for fastening it firmly to the end and sides of the horizontal piece.

The corresponding part of the joint, which is calculated more for being fastened to a vertical part of a frame, consists of a flat plate, from the top of which projects a strong square hook, or piece of metal with a square cavity in its upper part, made to enter the square mortise in the first-described joint, and to gripe the part of the plate above it firmly, when the latter is pressed down; and from the lower part of this second plate a strong square staple projects, in which the tenon at the bottom of the first-described plate fits exactly: this plate is also perforated with screw-holes, for securely attaching it to the part of the frame, which is to be joined to the other part, to which the first-described portion of the joint is fastened.

The two parts of the joint are united by inserting the hook of the one into the square mortise of the other at its lower part, so as to admit the square staple at the same time to pass beneath the bottom of the tenon; the two plates being then in close contact, are locked together by forcing down the mortise plate, by which the tenon enters into the staple, and part of the plate above the mortise passes into the cavity of the hook at the same time.

Observations.—The patentee states, that these joints will tend to preserve the furniture in which they are used, from that racking which taking it to pieces usually occasions; will prevent vermin from harbouring in the cavities, from their not being able to endure the contact of metal; and will also render the frame stronger and more durable than common joints, in which the timber is so much cut by mortises, tenons, and screw-holes, as to be much weakened and made more liable to decay.

The patentee recommends these joints for such sofas, chairs, and tables, as are to be frequently removed, and also for the frames of spinning-machines and mill-work.

We feel pleasure in coinciding in opinion with the patentee, relative to the advantages above-stated likely to arise from these joints, and think that any objection that might occur from the great facility of their separation, could be easily obviated by the addition of thumb-screws at the staple or at the hook.

The patentee thinks the use of these joints would render tent-bedsteads a useful substitute for press-bedsteads, to which he justly objects, from the close confinement of the bed-clothes in them, being liable both to generate and to communicate disease; but as a scarcity of apartments alone renders press-beds a convenience, a measure which presupposes the reverse of this, obviously cannot preclude their use.

Press-bedsteads might be made wholesome, by apertures being formed in the upper and lower parts of their backs, to admit of a circulation of air when they were shut up; and with this addition,

those of the more lofty kind at least would be quite free from stagnated fumes, and would form in well-sized rooms places for repose infinitely preferable, in point of healthiness and cleanliness, to the extremely small bed-rooms, or rather bed-closets, which the cupidity of those who let lodgings has rendered so very common in London, from its inducing them to divide and subdivide their rooms to the smallest dimensions in which a bed can stand: to the use of which small rooms many, who are now pining in consumptions and asthmas, may fairly trace the first injury to their constitutions, and the foundation of all their subsequent misery.

Patent of JOSEPH BAGNAL, *of Walsall, Staffordshire, Sadlers' Ironmonger, for a Method of making Bridle-bits, Snaffles, and Bradoons for Horses, Martingale Hooks, and Rings of Iron, Steel, or other Metals. Dated July,* 1811.—*Repertory of Arts, No.* 117, *Second Series.*

THE patentee observes, that the method of having the reins fastened by a buckle to the bit of a bridle, in order to admit of their being separated from the bit, for cleansing either or both of them, has been found dangerous to the rider who used such a bridle, from the tongue of the buckle being liable to give way, and the leather being apt to break, from its having been weakened to admit the buckle: for this reason he supposed that a method for effecting the same purpose, not subject to those accidents, would be advantageous, and he states his patent plan for connecting reins to bits, to possess all the convenience of speedy separation, while the strength both of the leather and metallic parts is preserved perfectly unimpaired. The following is his description of this plan given in his specification.

"This invention, or contrivance, is effected, by making the rings, sides, or cheeks of bridle bits, snaffles, bradoons, martingale hooks, rings, or other work, with an opening or division thereon, guarded and closed by moveable levers, slides, pins, catches, rollers, or springs; whereby the heads, reins, harness, leather, or other work, may be fastened, put on, or taken off, without the use of buckles, or without stitching or unstitching, when the parts are required to be cleaned, altered, or repaired."

For the particular description of the method of securing the reins to the bits, the patentee refers solely to two figures; the first of which he states to denote the improvement, or catch of the *eye*, which fastens the leather or other work on the bits; and the second to denote the leather or other work which moves off and on the bits.

The latter figure represents a simple loop, formed by doubling the leather and stitching it; but the first figure (which is stated to

contain the chief part of the invention) is so imperfectly drawn, that it is impossible to know any thing more of it, but that it consists of a ring, passing through the end of the bit, with an opening in it to admit the rein, which opening there is some method known to the patentee of closing up when required.

Observations.—It may be unfortunate to the validity of this patent, to have such a very imperfect description given in the specification of the chief part of the contrivance. We think, however, that the idea on which the plan is founded is a good one; and that a ring formed like those used for watch chains, might effect the purpose required with sufficient security.

Patent of WILLIAM FOTHERGILL, *of Greenfield, Flintshire, Copper-forger, for a Method of making Copper Rollers for Printing. Dated September,* 1811.—*Repertory of Arts, No.* 118, *Second Series.*

MR. FOTHERGILL forms his copper rollers solid from their centre or core to their surface, from blocks or ingots of copper, in the following manner, instead of making them of flat pieces of copper, according to the present practice.—He first casts from melted copper, in wrought-iron moulds, blocks or ingots of copper nearly square; then he heats them in a furnace till red hot, and then by means of cast-iron rollers, having grooves in them and worked by water-wheels or other sufficient power, draws out or fashions these blocks into cylindrical shapes. These he again heats red hot, and then immerses them in cold water, which removes the scales and other impurities from their surfaces; then, by means of an iron forge-hammer, having a polished groove in its head, of the size and diameter of the intended roller, and worked by a water-wheel or other sufficient power, so as to fall on an iron anvil, having also a polished groove on its face, corresponding to the groove in the hammer, he compresses and hardens each cylindrical ingot, and at the same time makes it perfectly straight and true, fit to be formed into a roller or cylinder for printing muslins, calicoes, and linens; and he completes the roller by boring it through by common boring machines, turned by water or other adequate power.

Common rollers, made from flat pieces of copper bent round and turned, having the seams or joints soldered, or fastened by pieces inlaid, Mr. Fothergill states to have some parts of them harder than others: by which it happens that they wear unequally, so that the engraving made on them is soon worn off in some places, and the print becomes defective. Some colours also corrode solder, which adds to the deficiency of the present method: from these defects

Mr. Fothergill asserts his patent rollers will be entirely free, by his mode of making them; and will have the farther advantage, that when the pattern engraven on them is worn out or done with, it may be turned off, and other new patterns be engraven on them.

Observations.—It is probable, that for large rollers, hollow cylinders cast an inch or more in thickness, and hammered cold on iron cylinders, supported at each end, would have nearly the same advantage as those above-described; while their cost would be much less, from the expense and loss in boring them being saved; which for large cylinders would be very heavy.

Patent of JOSEPH BAKER, *of Butler's-green, near Cuckfield, Sussex, Navy Contractor; for Kneading Dough by means of Machinery. Dated Nov.* 1811.—*Repertory of Arts, No.* 118, *Second Series.*

MR. BAKER'S machinery for kneading dough, consists of a vertical mill-stone, made to revolve in a circular trough, by having its axis attached to an upright shaft turning on a pivot in the centre of the trough: in the same manner as in the common mills for crushing bark. This mill is to be turned, by horizontal arms proceeding from the upright shaft, either by men or horses; and the flour being put into the trough with a due proportion of water, will, it is supposed by the patentee, be kneaded fit for making bread, by the action of the stone revolving in the trough. Small shares are to be fixed to the horizontal arms, so as to run in the trough, and act like ploughs to turn up fresh surfaces of the dough, at every revolution.

Observations.—A good machine for the purpose above stated, has long been a desirable object in other countries as well as in this. The Society for the Encouragement of National Industry at Paris, proposed a prize of 500 francs for a machine of this nature, in August 1810, which is to be continued to 1814, if not claimed before.

An account of a machine for kneading dough, used in Genoa, in 1789, taken from the Transactions of the Patriotic Society of Milan, may be seen in the third volume of the Repertory, First Series; which machine consists of a kind of plough, or vertical wedges, made to move round in a circular trough by machinery, similar to that described in the specification. It is propable this machine was not effectual, from the prize above-mentioned being offered in Paris, where the machines used in Genoa must be well known. Whether Mr. Baker's machine will have the effect desired, remains yet

to be proved; but the operation of the vertical stone seems to have too little affinity to the process of kneading by hand, to afford any very sanguine hopes of its success.

Patent of* JOHN HUDSON, *of Cheapside, London, Paper-hanger; for a Composition for printing on Paper, Linen, Stuccoed Walls, and Fir, for the purpose of ornamenting Walls and Ceilings. Dated Dec.* 1811.—*Repertory of Arts, No.* 118, *Second Series.

MR. HUDSON'S composition is a powder, compounded of fine sand, talc, leaf-gold, or what the patentee calls *spreckles*, and pulverised flake glass, reduced to a certain degree of fineness, by spreading it thinly over a sheet of fine paper, and rolling the paper and glass round a cylinder of about two inches in diameter; and repeating the operation till the glass is broken down to the fineness required. This method preserves the brilliancy of the glass which bruising would injure; but when it is to be mixed with colour this trouble need not be taken: the gold-leaf is pulverised by grinding it with about two ounces of flake glass to one leaf of gold.

The sand, usually called silver or writing-sand, is used for shadowing, when the glass and talc alone would be too brilliant for the required effect: and various degrees of fineness of the materials are obtained by sifting them through brass-wire sieves.

When the composition is required to be less brilliant, the materials mentioned are mixed with size or body-colour of the tint desired, in quantity proportioned to the degree of lustre prefixed, and are then dried, and rolled with the cylinder ready for use.

When paper is to be ground for printing on, or for stiles, fillets, and mouldings for pannelling, a frame is to be fixed about eight feet above the colouring table, and parallel to it, on which a square sieve, about twenty-three inches broad (the usual width of paper for hangings), is made to traverse backward and forward on four small wheels running in grooves, by cords and pulleys passed from it to both ends of the frame. The percussions necessary for the operation of sifting, are given this sieve, as it moves along the frame; by small pieces of leather about a sixteenth of an inch thick, glued on the bottom of the groove at about two inches distance from each other; which will cause the sieve to shower down the composition in regular quantities as it is moved over the table.

For printing paper hangings, a sieve of the same kind as above described is slung over the printing table, with a cord and balance weight, similar to that used for lamps; by which it is lowered when wanted to sift over the composition, which is usually once for every three prints.

For painting the side of a room, pannels, or stiles in distemper, or body colour or oil colour, when the colour intended to be used is just about to set into a jelly, half a pint of the materials mentioned, of which talc is to form the largest proportion, is to be sifted into each gallon of the colour, stirring it continually, which should also be done while it is used; and this will render the brilliancy of the composition durable.

When greater brilliancy is required; while one person is colouring with the above preparation from the bottom to the top of a wall, a second person is to throw on the composition, or such of its ingredients as are preferred, with a sieve of woven brass wire, in form like a wooden mallet, with one end made to unscrew, to receive the composition.

Observations.—Accounts have been published here a considerable time ago, of a composition, of the same nature as that above described, having been used long since in India for ornamenting walls; on which it is reported to have a very beautiful and brilliant effect, particularly by candle-light. But whether this species of glittering decoration will be ever much used in this country, must probably depend on the fancy of the capricious leaders of fashion.

Patent of* THOMAS PEARSALL, *of Willsbridge, in the Parish of Bitton, Gloucestershire, Iron Manufacturer, for a Method of Constructing Iron Work for certain Parts of Buildings. Dated October,* 1811.—*Repertory of Arts, No.* 118, *Second Series.

MR. PEARSALL states, "that the principle of his invention consists in the application and fixing of thin malleable iron plates, in an edgewise position, so as to render them capable of sustaining a very considerable weight." Roofs are described to be formed on this plan, by uniting each pair of iron rafters with horizontal cross-ties near their heels, and a vertical piece descending from the point of junction of the rafters at the top to the middle of the cross-tie, so as altogether to form a frame trussed and braced in a similar manner to that of the large bearing frames of timber roofs. Every pair of rafters with its bracing pieces forms one of these iron frames; and when they are set up in their places, they are connected together laterally by laths of iron, placed at regular distances from each other, and wedged into apertures previously formed for them in the rafters. This roof may be farther strengthened, if required, by braces placed at the under side of the rafters and ties, laid either flat or edgewise. Iron about three inches and a quarter wide, and

about one-eighth of an inch thick, is stated by the patentee to have been found to be sufficiently strong for rafters to bear with ease the common pantile covering over a span of twenty-five feet; and the iron ties stays, and laths, are mentioned to have been found to be of a proportionate size to these rafters, when one inch and three quarters wide, and one-sixteenth of an inch thick.

Figures are given of three roof-frames on this principle, in the specification; the first for a roof of twenty-five feet span; the second for a roof between twenty-five feet and forty feet span; and the third for a roof above forty feet span.

The only peculiarity in these figures of frames is, that they have curved braces, and ties, mixed with straight ones; for which no reason is assigned.

The patentee states, that joists for floors may be constructed of iron on the principles described for roofs; and that ceilings and partitions may be formed of thin iron frame-work in the same manner; and that skeleton-frames for stairs, to receive steps of wood or stone, may be made in the same method; and also doors, windows, and other frames of a like nature.

Observations.—Cast-iron is so much cheaper than wrought-iron, that it is most probable that a roof equally strong may be formed of this substance much cheaper than the one of malleable iron described; cast-iron would besides have the advantage of being vastly more durable, from being so very much less liable to corrosion from rust, to which the great thinness of the wrought-iron proposed by Mr. Pearsall for his roofs would particularly expose them.

The curved braces introduced into Mr. Pearsall's plans for roofs, along with straight braces, form an injudicious combination; since the strains, bearings, and expansions, of curved and straight pieces will be so very different, as to cause the greatest part of the pressure to fall on some of the pieces, while others will have scarce any force to sustain. Straight braces throughout would therefore be preferable; but as this is not an essential part of Mr. Pearsall's plan, the correction may be made without producing any alteration in its other parts.

Where very light roofs are wanted, Mr. Pearsall's plan might be adviseable: but for the reasons before-given, it does not appear probable, that wrought-iron roofs of any kind can have much chance of success in the competition with cast-iron roofs; which appear only to require fair trial in order to make their adoption very general.

Patent of JOHN MIERS, *of the Strand, County of Middlesex, Jeweller, for a Method of accelerating the Evaporation of Fluids; of Destroying the noxious and offensive Effluvia from Spent Lyes, and other Substances; and of generating an increased Heat, without additional Fuel. Dated October,* 1811.—*Repertory of Arts, No.* 118, *Second Series.*

THE evaporation of fluids is accelerated, in Mr. Miers's method, by having the top of the evaporating vessel covered in such a manner, that an opening is left at one end for the admission of air, and by fixing at the opposite end a flue, or other conveyance, to conduct the vapours and air from above the boiler to the ash-pit, from whence it is caused to pass through the fuel and ascend the chimney, by closing the doors of the ash-pit, and a current is thus caused over the surface of the evaporating liquor, which much accelerates the process.

The offensive effluvia arising from various manufactures, Mr. Miers destroys in some cases by the apparatus above described; and in other cases he causes the effluvia to pass through red hot tubes containing carbonaceous matter, or substances which easily yield oxygen, or by having steam admitted into them, according to the nature of the effluvia to be decomposed.

The increased production of heat is effected in Mr. Miers's method, at the same time with the advantages mentioned in the processes described; since most of the vapours made to pass through the ignited fuel in the manner described, will be decomposed into principles, which are either combustible, or supporters of combustion: and even the steam of water is of this nature.

The patentee mentions further, that he has decomposed sulphuretted hydrogen, by passing it through ignited tubes in contact with aqueous vapour: having found that at high temperatures steam decomposes this gas.

Observations.—The discovery last-mentioned is that most likely to be valuable to the patentee, as he can apply it to the purification of coal gas, for lighting houses, so as to have a decided preference in constructing apparatus for this method of producing light, which is now coming into general use for large manufactories.

It has long since been proposed to destroy foul air in ships, and other places, by causing it to pass into the ash-pits of furnaces.

The method of accelerating evaporation, by causing a current of air to pass over the surface of a boiling liquor, has also been in use: a description of one mode of applying is published in one of the last volumes of the Transactions of the Society of Arts, and in Repertory, No. 121, which differs indeed from Mr. Miers's plan, in having a separate flue for the steam; but this in some cases would be preferable.

For these reasons the patentee will not probably have much demand for these two latter applications of his invention; and as for that where red hot tubes are used, it seems too difficult to manage for common use at present.

Patent of Mr. RICHARD WITTY, *of Kingston-upon-Hull, for further Improvements in his Invention for the Construction of Steam Engines, secured by a former Patent in February,* 1810. *Dated October,* 1811.—*Repertory of Arts, No.* 119, *Second Series.*

MR. WITTY'S former patent was for rotative steam engines, the revolving motion of which was effected by weights alternately drawn to and driven from a centre, round which a working cylinder or cylinders revolved; and to the opposite ends of the piston rod or rods, that passed through the said cylinder or cylinders, the weights were attached. The improvements on these engines, for which the present patent is taken, Mr. Witty states "to consist in making the piston draw or force round the machinery to be worked by it, whilst itself moves both in a rectilinear and rotary direction in a cylinder or steam vessel; which also revolves upon an axis, placed either in an horizontal, vertical, or oblique position. The mechanical contrivances by which this is effected, are of various kinds, which cause the power of the piston to draw or force the cylinder round; and move the mill-work, or machinery, which is attached to the engine, by the revolution of the axis or shaft of the revolving cylinder, or by the piston rod being made to act upon a wheel, or other contrivance, upon a separate axis or shaft, fixed or otherwise as occasion may require.

To admit the action of the steam, and of the condenser, in the revolving cylinder, its axis is bored lengthwise in two places, so as to form two passages, each of which communicates by lateral pipes with the end of the cylinder opposite to the side of the axis in which it lies; the extremity of this perforated axis is formed of a conical shape, and turns in a box made to fit it, in the same manner that the revolving part of a common cock turns in its barrel; from the upper part of this box a pipe passes to the steam boiler, and from the lower part another pipe proceeds to the condenser, and lateral apertures are made through the sides of the axle to the two passages within it before-mentioned, which, as the axle turns, alternately communicate with the steam pipe, and the pipe of the condenser in the box, in the same way as a cock with two ways acts; with which cock this part of the engine is on the same principle. The axle projects through the box, and has a crank at its end, by which it works the air-pump of the condenser.

Several principles are mentioned by the patentee, on which the cylinder, prepared as described, can force itself round; which are all of the nature of crank or cardioid motions: both of which however may be referred to one source, as they are caused by an apparatus made to protrude and retract alternately between two centres, one of which revolves, and the other is fixed.

The first of these principles stated by the patentee, (which he calls a cardioid motion, though it is more properly a crank motion,) effects the rotary movement by the action of a moving groove on a fixed centre; which groove is placed at right angles to the cylinder, in a frame that is connected with piston rods proceeding from the opposite ends of the cylinder, and of course partakes of their alternating motion.

The second principle consists of the operation of the ends of piston rods, proceeding from the opposite extremities of the cylinder, on the outside of the rim of a large wheel, whose centre is placed at the distance of about half the stroke of the piston from the axis of the cylinder. The rim of the wheel projects so as to extend to the line of the piston rods, which are bent round to support friction-wheels outside it, that alternately come in contact with steps on the rim, and by them force round the wheel, by a cardioid motion; or, in other words, by a motion similar to that which levers would cause, when made to press alternately on the outside of a heart-wheel.

The third principle is a variety of the second, and consists in making the large wheel before-mentioned revolve on a ring, supported by friction-wheels, which includes within its circumference the axle of the revolving cylinder. A species of this last mode is mentioned by the patentee, that deserves particular notice, in which the ring is large enough to include within it the cylinder and protruded piston-rods, and is to be placed in the plane of the piston-rods, and at right angle to the axis of the cylinder.

The fourth principle consists in the action of the piston-rods, arranged as first mentioned, against the inside of a heart-shaped ring, placed vertically with its apex downwards, one half of which ring is moveable outwards by being suspended from a hinge at its upper end. The axis of the revolving cylinder is placed in one of the centres of this cardioid-ring; and the ends of the piston-rods, furnished with friction-wheels, press alternately on the fixed and on the moveable sides of the ring, and thus produce the rotative motion.

A fifth mode, mentioned by the patentee as a variety of the first, deserves to be noticed by itself for its greater simplicity; it consists of a crank a quarter the length of the stroke, or a fixed centre placed at that distance from the axis of the cylinder, from which a rod passes to the top of the piston-rod. In this method, and also in the first, a strong iron knee proceeds from the fixed centre to sup-

port the gudgeon-end of the axis of the revolving cylinder, or that end which is opposite to its perforated extremity. The end of this knee next the fixed centre is driven tight into a piece of cast-iron and keyed fast, which piece is bolted down to a beam of wood that supports it. The fixed centre lies between the angle of this knee and its support.

The advantages of steam-engines, constructed on these principles, over common engines, the patentee mentions to consist in saving the power lost in the motion of heavy engine-beams, parallel apparatus, valves, hand gear for moving valves, and plug-frames, none of which are used in his engines; and in the great simplification of machinery, which arises from their removal. The patentee also states, that the ponderous fly-wheel, used to regulate the motion in other engines, may in his be in a great measure dispensed with.

Observations.—In the above account of Mr. Witty's patent it is mentioned, that he has described several *principles*, on which the object of his patent may be effected; because the engines themselves, by which those principles could be carried into effect, are not described in the specification with sufficient accuracy for execution; but, on the contrary, several essential parts of them are left to the imagination of the reader; and the descriptions in many parts are given in a manner that causes the greatest difficulty to comprehend them. For instance: in the account of the first method of causing the rotary motion, by what the patentee calls the parallelogram-frame, or trammel-groove, no mention is made of the method in which the ends of the piston-rods are to be connected with the frame. This difficulty does not appear on the first inspection of the figure given of this engine, because this figure represents the front of the frame, which causes the top of the rod, that in reality would be more than the semidiameter of the cylinder behind the frame, to appear in the same plane with it. If an arm is to project at right angles from the extremity of each of the rods to the frame, (which is the most likely method to have been intended, consistent with the figure), this would tend to bend the piston-rods, would occasion a binding motion, by which much force would be lost in friction, and would cause the rods to be worn at one side, and occasion steam to be lost from this circumstance. This shews that the omission is not a trivial matter; and several others of the same kind might be pointed out in the specification.

Inaccuracies of this nature are not of the small importance some may suppose; for as one of the conditions on which a patent is obtained, is, that a description be given of the invention, sufficient to enable an intelligent workman to construct the engine, or per-

form the operation which is the object of the patent, a deficiency of clearness in the description, as much as inadequacy in other respects, might destroy its validity.

When any good method is adopted for preventing the tendency to bend the piston, which an arm at right angles used to force round the engine would occasion, in the manner before-explained, then the fifth or last method described would seem to be preferable to most of the others, on account of its greater simplicity, and its having less friction than them.

On the contrary, the method in which the grooved frame is used seems the worst, on account of the binding, or increased friction, which grooves acted on by oblique impulses always undergo, especially when the degree of the obliquity approaches so very near a direction perpendicular to the groove, as it does on this occasion; which, added to the defect before-stated, would occasion a very great waste of the force of the engine.

Of all the methods, however, in the state in which they are described by the patentee, those two, in each of which the cylinder revolves within a ring that surrounds it in the plane of the piston-rod, at right angles to the axis of the revolving cylinder, appear the most advantageous; because in them less of the force is lost in oblique movements, and the piston-rods suffer no injury from any part of the machinery tending to produce lateral impulses.

Of these two methods, that with the revolving ring appears to be preferable, from its causing less friction, and producing a more free motion; and as the revolving ring might be likewise made to perform the office of a fly-wheel, it would also be simpler. A mode (not mentioned by the patentee) of applying the smaller ring, that extends only far enough to include the axis of the cylinder, and is described first in the account of the third principle of the patent, seems also preferable to the fixed ring, and nearly if not fully equal to the revolving ring, from the simplicity of construction of which its renders the engine capable.

The advantages stated by the patentee, that engines on these principles possess in comparison with others, seem in most respects justly represented: but, on the other hand, it must be observed, that there is much more force lost, in even the best of the methods proposed, from the obliquity of the impulse of the moving power to the motion produced, than in the beam engine and crank; as the latter acts in two points of the revolution at right angles to the crank, or in the direction of the motion produced which is the most advantageous direction; while in none of the plans proposed by the patentee does the impulse come much nearer the direction of the produced motion, than what would form with it an angle of forty-five degrees.

We must differ with the patentee also, as to the capability which he supposes his engines afford of dispensing with fly-wheels;

thinking on the contrary, that from the great variation of the force producing the rotary motion, in various parts of the revolution (on account of the great difference in the obliquity of its direction) the fly-wheel would be absolutely necessary to produce equable rotative motion in them.

But notwithstanding that some loss of force would be caused by the obliquity of the impulse to the direction of the motion (as before-mentioned), we think that very useful and powerful engines may be formed on the principles invented by the patentee, when they obtain those modifications, which practice and experience in constructing them will point out; and that next to Mr. Mead's plan for a rotative steam-engine, these of the patentee are by far the most ingenious yet laid before the public. We also think, that in point of simplicity, and in the facility of their being kept in order, and having the stuffing kept tight, and renewed when wanted, they are superior to Mr. Mead's engine; and that the species of them which revolves with a simple crank motion, and that with the large outside revolving ring, if not some of the other kinds, may be afforded at a considerably lower price than Mr. Mead's, or, when the mode of making them is brought to perfection, than most other steam-engines, on account of the number of parts and the quantity of framing used in other engines, that may be omitted in their construction.

Mr. Witty has mentioned, at the end of his remarks on his invention, that an engine was erecting then (January, 1812,) on his patent principle, at Hull. If he, or any other friend to the arts, would forward a description of this engine to the proprietors of the Repertory, it would gratify many who wish to know the effect of so curious a contrivance in actual work, and what modification of the invention has been found on trial to be the most advantageous.

As a good method of preventing the ill effect, mentioned farther back, which an arm projecting at right angles from the end of the piston-rod (for connecting it to the fixed centre by a moveable bar or frame) would occasion, is evidently a desirable object; the writer of this article takes this opportunity to mention, that three modes for effecting this purpose has occurred to him; one of which particularly he thinks would render the engine very complete, by facilitating the construction of one of its simplest forms. It may probably be useful to Mr. Witty to know this, if he has not thought of the same contrivance before.

Patent of JACOB ZINK, *of Globe-Road, Mile-End, County of Middlesex, Chemist, for a Method of Manufacturing Verdigris, to be called Imperial British Verdigris. Dated January,* 1812.—*Repertory of Arts, No.* 119, *Second Series.*

THE following is the substance of the directions given by Mr. Zink for making the article which is the object of this patent.

Having a copper vessel which will hold 300 gallons of water, fixed in an iron sand-bath somewhat larger than it, put into it from ten to twelve pounds of pure copper, cut small or granulated, with thirty pounds of oil of vitriol, and light a fire beneath the sand-bath: on the oil of vitriol getting warm, add to it eight pounds of pure water, and let all these together foam up and boil, until the necessary calcination is effected, and the matter in the boiler gets dry, which will be known by steam ceasing to issue from it.

The dry substance thus prepared, which is called by the patentee oxyde of sulphate of copper, is then to be taken out of the copper vessel, and the operation is to be repeated till a quantity of this article is made sufficient to saturate 300 gallons of water, which is to be previously placed in a large tub convenient to the sand-bath, and the sulphate is to be dissolved in it by repeated immersion, by means of an apparatus formed of a piece of strong canvas fastened loosely round a hoop of copper, which is suspended over the tub by a rope and pulley; on this canvas the prepared powder is to be placed, and to be alternately plunged into the water and drawn out, stirring the water continually till as much of it is dissolved as the water will take up.

Mr. Zink's verdigris is prepared by precipitating the above-described solution, with a solution of either vegetable or mineral alkali, formed by dissolving 150 lbs. of the alkali in about 300 gallons of water, in a proper sized tub; the precipitation is effected by mixing the two liquors in one or more pails, or in a proper number of tubs containing ten gallons each, which will be preferable; after which, the precipitate is to be freed from the liquor, cleaned, purified, and dried, in the following manner.

A number of stools or stands are to be prepared equal to the number of the tubs, on the top of each of which strong canvas is to be fastened loosely, on which the precipitate is to be laid to drain, when taken out of the tubs, which may be facilitated by stirring it with a wooden spade. When the precipitate is sufficiently drained, it is to be returned into the tubs, in each of which six gallons of water are to be thrown, and stirred well along with it, to free it from the saline liquor; it is then to be spread a second time on the drainers, and stirred as before till it is freed from water; after which it must be put into canvas bags, covered over with flan-

nel, and the remaining moisture be squeezed out by a press; and then it must be left on laths or boards, exposed to the air till quite dry.

The composition thus made, the patentee asserts, will "become perfect, and prove, in quality and virtue far superior to any verdigris manufactured in France, which has hitherto been always preferred and deemed inimitable."

Observations.—The patentee has made a misnomer, in calling this composition verdigris; for certainly, whatever may be its "virtue and quality," it is not acetate of copper, which verdigris is well known to be; but instead thereof carbonate of copper, which is a very different article; for as no directions are given to make the alkali used caustic, it must be inferred to be in the mild state, or a carbonate of the alkali preferred (probably carbonate of potash or pearlash); the effect of which with the sulphate of copper, managed as directed, would be to produce a precipitate of carbonate of copper.

The patentee has made another mistake, in calling the article, prepared from the copper and sulphuric acid, oxyde of sulphate of copper; for as he states it to be soluble, it must be sulphate of copper, the oxyde of copper being insoluble in plain water.

Whatever the difficulty may be of making verdigris equal to the French, we however have it in our power to state, that real verdigris is now made in Bristol, of British materials, by Mr. Washburn, equal to any imported from abroad, and much superior to most at present in the market.

Patent of JAMES SMETHURST, *of New Bond-street, Middlesex, Lamp Manufacturer, for Improvements applicable to Lamps of different Descriptions. Dated March,* 1811.—*Repertory of Arts, No.* 120, *Second Series.*

THE improvements, for which this patent is taken, seem principally intended for a lamp for which the patentee had a former patent; and which he calls his *oleum pneaumatic moon lamp.* In the first of the improvements mentioned in the specification, the oil chamber is stated to be divided into four chambers, one above the other, with pipes forming communications between them, in such a manner, that the oil shall pass from the upper chamber to the lower, without having the power of returning, by which the foul oil and dregs, which lodge at the bottom, are prevented from mixing with the fresh oil when poured in, and can be drawn off at the lower chamber by a cock provided for the purpose. The upper chamber is filled after the lamp is reversed, by a tube that extends from it to the bottom, where it is stopped by what the patentee calls a *plug and seat.* Tubes also pass between the chambers for

carrying off the foul air, which, with those before-mentioned, amount to no less than ten in number, as represented in one of the figures annexed to the specification; to which we must refer for an explanation of the intricacy of their arrangement, as without this figure, an adequate idea of it could scarcely be conveyed to the reader.

The second improvement consists of an addition to the lamp, which the patentee calls a *double cone globe*, formed by a stopper, that almost fills the upper orifice of the internal air tube of the burner, supported by a sliding wire, by which it may be brought closer or farther from the burning wick, as may be desired, and the quantity of air which passes through the tube to the flame be thereby regulated.

The third improvement consists of a glass chimney for the lamp, of which the glass is considerably thicker at the upper part than at the lower, by which it assumes externally the shape of an inverted cone. This formation causes the rays of light to be refracted downwards, instead of being lost at the upper part of a room, and thus increases the portion of light usefully employed; the polish is taken off from the inside of this chimney by grinding, which the patentee asserts, causes more light to be refracted than if the same operation was performed on the outside of the glass.

Observations.—The multiplicity of parts, and consequent complication, of this lamp, renders it liable to get deranged from leakage in some of its numerous pipes and chambers, difficult to be repaired, and hard to be kept clean internally: all which are particularly objectionable in an utensil which must be committed to the care of servants, who seldom give themselves much trouble to understand the nature of such articles, or to preserve them from those accidents to which their construction renders them liable.

The glass chimney of increased thickness above, promises to be a useful improvement; but its figure would both render it expensive, and would increase the hazard of its being cracked by the heat of the flame on account of the inequality of its thickness.

In conclusion, we must beg leave to notice the extraordinary names which the patentee has given to his lamp, and its parts. The expression *Oleum pneaumatic moon lamp*, is only objectionable for having a ridiculous sound, which cannot serve the invention; but in the name of wonder, what figure of a geometrical, or any other nature, can be designed by the name *Double cone globe*, by which the patentee has described one of his improvements? Words may appear of little importance, where things are the principal object; but surely expressions which tend to confound the most distinct ideas we have, should not pass unnoticed; nor should the notion be permitted, that the taking a patent gives a man any right to confuse the English language with impunity.

Patent of* GEORGE DODD, *of Vauxhall-place, in the County of Surrey, Engineer, for certain Machinery, and the Application of Steam to communicate Heat and Motion to Wines, Porter, and other Liquids and Fluids, in Cellars, Storehouses, or other Places. Dated January*, 1812.—*Repertory of Arts, No.* 120, *Second Series.

MR. DODD's invention consists in meliorating wine, porter, and other liquors, by applying to them heat and motion artificially, to imitate the effect which long voyages by sea in hot climates are known to have on them.

One method of producing the artificial motion, which Mr. Dodd gives as an example, is to construct in the storehouse, or other place where the liquor is deposited, framing of any convenient and suitable form, suspended, or erected, so as to be capable of receiving an oscillating, or other required motion, from the beam of a steam-engine, or other moving power; and to place on this framing the vessels of wine, beer, or other liquor, to be improved. The motion most desirable to be given to the framing is that of the rising, falling, pitching, and rolling motion of a ship at sea; which may be attained by giving the frame a circuitous as well as a vertical motion, varying the speed of it occasionally, so as to give it any required irregularity.

The heat desired may be obtained by raising the temperature of the storehouse, or other place where the liquor is deposited, by causing the flue or chimney of the steam-engine to pass through it, and having valves or dampers annexed to it, to admit or exclude the heated air or smoke as required: in which case the steam-engine fire-place should have a second chimney, and be furnished also with valves, to carry off the superabundant air or smoke. And lastly, the degree of humidity necessary may be obtained by means of a pipe, fitted with proper valves or cocks, leading from the boiler of the steam-engine into the place where the liquor is deposited, through which gusts of steam may be emitted at discretion.

Observations.—It is probable that the effect desired might be obtained, in buildings heated to the proper degree, by the mechanical motion described; or even by one of a simpler nature, or by oscillation alone. The artificial humidity might also be of use to keep the casks tight; but it is not easy to conceive what other purpose it could serve, as we cannot suppose it would penetrate through the casks or bottles which contained the liquor.

The chief question however is, whether the sale of the liquor so managed would be profitable; and of this we must be permitted to have our doubts.

Patent of ANDREW PATTEN, *of Hulm, in the Parish of Manchester, County of Lancaster, Iron-liquor Manufacturer; and* CHARLES HANKINSON, *of Hule, in the Parish of Bowden, County of Chester, Tanner; for a Discovery and Improvements in the Tanning of Leather by the use of Pyrolignous or Wood Acid. Dated Jan.* 1812.—*Repertory of Arts, No.* 120.

THREE methods are stated by the patentees, for the application of pyrolignous acid to tanning. In the first method the hides and skins are to be first limed, haired, fleshed, and beamed in the usual manner, to be well washed and cleared of the lime, and *masterings*, and then to be immersed in a pit of weak ooze or liquor made from oak bark, in which they must remain five or six weeks, and be handled well till they begin to bloom: they are then to be taken out and immersed in a pit of pyrolignous or wood acid, having first purified it as shall be mentioned, for ten or fourteen days, according to the substance of the hides or skins, taking care to handle them well every day. If the hides or skins be light, the pyrolignous acid should be weakened, by putting to it an equal quantity of water or spent ooze; or three or four times as much water or spent ooze, if the hides or skins be very light: the strength of the liquor must be regulated by the lightness of the hides or skins, and they should be handled well every day till they be sufficiently raised; and then they should be immersed in a pit of clear water, or not, as convenient, and should remain in it one or two days, and be handled well every day. Then, in order to bring the hides or skins as near as possible to the colour which is generally given to leather, they should be removed into pits of strong ooze, and be suffered to remain there for three or four weeks, or they may be put into two leys of bark, in the usual way of tanning, and remain in each three or four weeks, and then they may be taken up and dried for sale; but if the hides be very heavy, it will be prudent to let them remain a little longer both in the pyrolignous acid and in the ooze.

In the second mode of applying the pyrolignous acid (after the hides or skins have been limed, haired, fleshed, beamed, and washed and cleaned from the lime and masterings, as before mentioned,) spent bark is to be taken, or fustick, or American bark, or shumac from which the strength has been drawn by the dyer, or any other mode of using it, or any other kind of spent wood, or ground wood, or saw-dust; and any of them is to be mixed with pyrolignous acid in a pit, in the same proportion in which oak bark is used to make a strong ooze. And into this the hides or skins are to be immersed, taking care to handle them well once each day; after lying in this pit one day, they are to be removed into another pit, in which any of the ingredients above

mentioned is mixed with water, in the same proportion as with the pyrolignous acid; after lying in this pit one day, they are to be moved back again to the first pit, and this alternation of the pits is to be repeated every other day for six or eight weeks, according to the substance of the hides or skins, until they be sufficiently tanned, taking care to stir up the liquor in the pit well before the hides be put into it.

Light skins will be soon tanned in this manner, but they must be well attended to. Fifteen or twenty gallons of pyrolignous acid put into a pit of the spent ooze will renew it, and make it fit for receiving fresh hides.

In the third method, the pyrolignous acid is used alone, or only has the other articles added to it in the filtering or clearing, and very good leather may be thus made. Heavy hides not more than half tanned may be taken out of the bark ooze, and be immersed in the pyrolignous acid, taking care to handle them well, and they will be tanned through in two or three weeks, after which they may be taken out and put into a pit with a layer of bark, and be left there for two or three weeks until they be finished, and have a good colour, when they are to be taken up and dried for sale; using the bark after the pyrolignous acid, takes away the smell, and gives the leather a better colour.

The method used by the patentees, for purifying and clearing the pyrolignous acid from tar, and oily matter, is to heat a quantity of it in a pan, and immediately to throw over its surface a quantity of fine ground dry spent bark, taking care, as soon as the surface of the liquor is covered, to skim off all which lies on it; these operations are to be repeated, till about half a pound of the bark for every gallon of the liquor has been thrown in; and the skimming is to be continued till the liquor comes near boiling, and then the fire is to be drawn from under the pan, and the liquor emptied from it into a tub, or tubs, to cool and settle; after which it is fit for use.

To prevent any of the tanning principle from being lost, what is skimmed from the pan, and what has settled at the bottom of the tub, are to be mixed well with water sufficient to extract the remaining strength from them; and then are to be left to settle, when the clear liquor is fit for use. If the tanner prepares his own liquor, these skimmings and residua may be thrown into the leak pits, or spenders, which will make a stronger liquor for tanning than a pit of fresh ooze; and, for clearing the pyrolignous acid, spent fustick, spent shumac, spent American bark, ground wood, or saw-dust, if freed from colour that might injure the leather; or ground pipe clay, or other clay or loamy earth, if it contain no metallic matter, may be used instead of the bark, for throwing over the surface of the liquor in the pan, to clear it as before mentioned; but the patentees prefer the bark: they have also used lime and

whiting for the same purpose, and have found that with either, the liquor retains a tanning principle, but has not the same effect as when cleared in the way before described.

Observations.—As one of the methods proposed by the patentees for tanning, by which they assert very good leather may be made, is to use the pyrolignous acid by itself, their new process seems to bid defiance to all the former theories of tanning; in which a principle, contained in many substances, called tannin, was supposed to have an effect in hardening and making insoluble the gelatinous and other parts of skins, which converted them into leather. This should induce the patentees to lay before the public the strongest proofs, that leather prepared in their manner is as good as that tanned in the usual method; since otherwise much doubt will be entertained on this point, for the reason stated.

If it should be proved that pyrolignous acid really has the property of tanning leather by itself, it will be a most valuable discovery; and will add another to the many beneficial uses to which this acid is now applied, and give reason to suppose it may yet rival sulphuric acid in the extent of its application in the arts. It will also give us another cause to be thankful to the memory of the learned Glauber, who first recommended this acid to notice, and pointed out several of its valuable properties; some of which, not yet applied to profit, these discoveries may induce others to try on his recommendation.

Patent of WILLIAM STRACHAN, *of Pool Cottage, in the County of Chester, Chemist, for a Method of preparing the Ore of Cobalt for the various Purposes to which it is applicable in Trade, Manufacture, and Painting. Dated Sept.* 1811.—*Repertory of Arts, No.* 120.

MR. STRACHAN'S method of preparing the ore of cobalt relates to the reduction of it into a fine powder, which he effects in the following manner.

First, when the ore is taken from the mine, it may be partially freed from the silex and earthy matter, with which it is generally combined, by a small pick-axe or hammer; and must then be exposed to the action of the air, to free it from moisture. Secondly, a vessel of iron, or other hard metal, must be provided, resembling in form a common boiler, and of any convenient size, the bottom of which must be perforated with numerous holes, from a quarter of an inch to three eighths in diameter, as close together as the strength of the vessel will admit. Within this vessel a pestle must be made to work by any mill-work, or

mechanic force. The bottom of this pestle must be made to correspond in convexity with the cavity of the vessel, so that the blow given by it may be equally applied to the whole of the surface. The perforated vessel is to be placed on a strong wooden frame, and a space must be left under it, eighteen inches square and one foot deep, to receive the pounded ore, as it falls through. Into this vessel the ore must be put, and be pounded until it passes entirely through the holes; after which it must be sifted through a fine sieve, to separate the earth and sand; and when it is ground very fine, the same operation of sifting must be repeated. After this preparation the ore may be considered to be in a fit state for tinging glass of a beautiful blue colour; and when more concentrated it may be used for making smalt blue.

The patentee states that the ore may also be cleaned by other methods. First, by passing it through rollers of iron, or hard wood. Secondly, by beating it upon a hard substance with a hammer, or wooden beater. Thirdly, by spreading it thinly on a floor of metal, hard wood, stone, tile or brick, and passing a weighty roller over it, composed of metal, hard wood, or stone. Fourthly, by the friction of a machine of a cylindrical, cubical, or oblong form, made to revolve round its own axis: in these four last methods, the ore must be regularly sifted, as in the first mode. All these methods the patentee claims as his invention, but gives a decided preference to the first.

Observations.—It is generally understood that cobalt ore must undergo a considerable exposure to fire, in various ways, to free it from the arsenic and other matters, with which it is found combined, in order to prepare it for use; we were therefore surprised to find that Mr. Strachan, who as a professed chemist, should be well acquainted with this part of the preparation of the ore, should appear either to be ignorant of it, or to think it not worth his notice, and should confine his ideas merely to the mechanical part of the progress, which is considered justly to be that of by far the least consequence.

The first mentioned method of pounding ore seems to be a new contrivance, and may probably be applied beneficially to other similar operations; but really the patentee cannot escape censure for claiming as his invention, the other modes of reducing ore to powder, which he mentions; all of which have been well known to have been employed for the comminution of friable substances, from remote periods.

In the chemical part of the preparation of cobalt ore, the workmen suffer much from the effect of arsenical vapours; improvement in this part of the process is therefore extremely desirable; and when we saw the title of the patent, in which the patentee

styles himself chemist, we hoped that his improvements in the process were of a chemical nature, and might relate to the above object; we must own, therefore, we felt much disappointment every way on reading the specification of this patent; and think the patentee will feel the same, as to the advantage he hopes to receive from it, since there are many ways of reducing ore to powder equally good, or better than these he first describes, to which his patent can in no way extend.

Patent of ROBERT GOSWELL GILES, *of the City of London, Merchant; for a Cap or Cowl, on a new construction, to be placed on the tops of Chimneys. Dated Feb.* 1812.—*Repertory of Arts, No.* 121, *Second Series.*

THE form of Mr. Giles's chimney-cap, may be easily understood by supposing a hollow cylinder about a foot long, and double the diameter of the upper end of one of the common chimney-pots, supported by brackets extending from the top of one of these pots, so as to include from three to six inches of the top of the pot within its lower part; and to extend the rest of its height above the pot; about the middle of the part above the pot a convex lid, a quarter of an inch larger in diameter than the top of the pot, is suspended horizontally by brackets, exactly over the top of the pot, and about three inches above it. The cap is contracted at its upper end by a rounded termination, so as to leave an aperture a little larger than the top of the pot, for the smoke to pass. The horizontal lid in the centre of the cap, prevents the wind from blowing down the chimney, and the rain from falling into it; while the intervals between its rim and the cap, and between the top of the pot and the internal circumference of the cap, leave an ample space for the passage of the smoke.

Observations.—The old chimney-pots with tops crossing in two directions, were intended to have the same effect as Mr. Giles's patent caps, which seem preferable to the crossed pots, both from being much easier made, affording a better passage for the smoke, and, when the wind chances to blow downwards on them, enabling them by their internal formation to have an effect in continuing the draft by a lateral communication of motion.

In point of simplicity, and being little liable to derangement, this cap is preferable also to the turning tops, and seems likely to be equal, if not superior, to them in efficacy.

Patent of MICHAEL LOGAN, *of Paradise-street, Rotherhithe, County of Surrey, Engineer; for an Instrument for the generation of Fire, and various purposes in Chemical and Experimental Operations. Dated September*, 1811.—*Repertory of Arts, No.* 121, *Second Series.*

THIS instrument, as well as we can understand the confused account given of it in the specification, consists of a tube about nine inches long and an inch broad, terminated by a hollow hemisphere of metal, and attached to a staff about two feet long. In the hemisphere is an orifice about a quarter of an inch wide, for charging it; this orifice is closed by a conical stopper, opened and shut by a lever and spring; from the end of which lever a wire extends to a trigger in the handle by which it is moved; under the collar of the vent-plug, or stopper, the patentee mentions, that "the air-vent is situated close to the upper orifice, so that when the plug is raised, the pressure of the atmosphere instantly takes place, and gives a drop of the fluid contained in the tube for each stroke or jet of the regulator." What this fluid may be, or its use, the patentee only gives us an oblique hint of, in stating that the materials of the tube are not to be limited, in the following words: "I do not confine myself to any material substance whereof the same may be constructed, which will contain and withstand the action of the fluids either pure spirit or acids, whether simple or compound, which generate, or produce the effect of inflammability or fire, being brought in contact with pyrotechnic compositions." And of these compositions the patentee says no more directly, than that "their commixtures are so various, as would require a volume to describe them, and consequently cannot, therefore, become the subject of specification here, many of which are so well known by fire-workers, that almost every link-boy or sweeper knows how to generate fire." But a little further on he gives us a hint respecting them, by stating that the instruments employed should be adapted by their construction, "so as completely to exclude all humidity and absorptions of the atmosphere, particularly when the acids are employed, or when the phosphoric or pyrophoric substances are used."

Observations.—It is true, that there are fluids, which, dropped on certain substances, will produce flame; but neither these nor their management are so commonly known as the patentee asserts; and since he has neither stated what these fluids or substances are, nor any mode of applying them to the discharging artillery, or the other purposes which he mentions, we conceive that he might

as well have saved himself the trouble and expence of taking a patent, since it cannot secure him in the exclusive right to more than he has described in his specification, which appears to us so inapplicable either to the purposes of the title, or to any thing else, as to be altogether nugatory.

Patent of JOHN HIVES, *of Holbeck, Yorkshire, Linen Manufacturer, for a Machine for Hackling or Dressing Hemp, Flax, and other Materials. Dated August,* 1809.—*Repertory of Arts, No.* 121, *Second Series.*

MR. HIVES's machine for hackling contains a revolving prism of eight sides, on four of which two sets of hackles are fixed on each, while on the other four sides back-boards (resembling small tables) are supported by screws, so as to be raised or lowered to the exact position found to be most suitable for receiving the flax as it passes from the heckles. This octagonal prism is formed of two octagonal frames of cast-iron or wood, about fifteen inches in diameter, placed at right angles on the opposite extremities of an axis, which turns horizontally on a stand made to receive it; and between the corresponding sides of the octagonal frames are fastened rails or boards, which constitute the sides of the prism, to which the heckles and back-boards are fixed.

Above this revolving prism, and parallel to its axis, a horizontal rail is supported by the ends of two levers, turning on centres in two uprights rising from the middle of the stand; from the opposite end of which levers bars descend to two cranks in another axis, that turn horizontally in the same stand, parallel to the revolving prism, and a little behind it. The use of this moving rail is to hold the flax or hemp to be hackled; which it is enabled to do by two corresponding pieces of iron about eight inches long, indented about the eighth of an inch at the inside, and fastened together by screws at their ends, which serve to screw the two pieces tight together upon the flax when placed between them: square hooks of flat iron are fixed to the front of the rail, to support these flax-holders; and as the sides of these hooks are made to contain the ends of the holders exactly between them, they sustain them firmly when placed in them, and admit of their being easily changed when the flax is hackled; a pair of flax-holders, and hooks to support them, are placed on the rail for every row of hackles in the revolving prism. When the flax is put in and the machine turned round, the rail that carries the flax-holders is made, by the action of the cranks and levers mentioned, to rise about five inches, during the time that the hackle passes under it, and to fall again immediately after the hackle has passed it; which gives the flax a stroke down upon the hackle, and makes the points of the hackle-pins pierce the

fibres of the flax, which are split by the continued motion of the hackle. Each of the flax-holders contains about six or eight ounces of flax or hemp, when it is slid in between the hooks that sustain it on the rail; and as soon as the flax is hackled at one side, the boy who attends the machine turns the other side of the flax-holder and replaces it between the sides of the hooks; and in the same manner the flax is transferred to be worked by the finer hackles, which constitute the second set on the same side of the revolving prism.

The machine is put in motion by a grooved wheel, or pulley, on the axis containing the cranks, so connected with a moving force, as to receive about one hundred revolutions in a minute; a toothed pinion on the other end of this axis gives motion to the revolving prism, by an intermediate toothed wheel, placed between it and one on the axis of the prism; the proportion of which last wheel to the pinion is such, as to cause it to make one revolution for four of the cranks.

Observations.—Any one who has seen the operation of hackling performed, and has noticed the address and dexterity which it requires in the hackler to manage it so as to make little waste, and to avoid breaking the fibres much, will not easily be led to believe that the machine described can perform the operation as well, or with as little waste, as it can be done by hand; but if the contrary should really be the case, the patentee would do much service to the linen trade, by laying before the public such authentic documents of the good performance of his engine in the above respects, as would effectually remove all doubts on the subject. If the machine should even do no more than prepare the flax for hackling by hand, so as to facilitate and abridge the labour of that operation, it will still be an invention of consequence, as it is understood with good reason to be a very material object, to deliver the linen trade as much as possible from the combinations and caprice of the workmen engaged in this occupation.

Patent of GEORGE LOWE, *of Cheapside, London, Cotton Spinner, for an Improvement in the Manufacture of a Fabric composed of Flax and Cotton, which is applicable to many useful purposes. Dated June,* 1808.—*Repertory of Arts, No.* 119.

MR. LOWE describes his invention in the following manner.—The flax when hackled is to be bleached by laying it on the grass; when the exposure to the air will have the effect of dividing or opening the fibres, by which means it will be rendered of a very fine texture. When perfectly white, it should then be made straight by being drawn again through the hackles, and then be

cut of a proper length to work with the cotton; an equal quantity of the cut flax and cotton, or any other proportion, may then be mixed, carded, and spun together.

Observations.—The fabric produced, by yarn composed in this manner, would be inferior to cotton for either dying or printing, as flax receives colour in any method with much more difficulty than cotton, and retains it perfect for a much shorter period. But we presume the chief object of the patentee is to produce webs fit for shirts, sheets, table-cloths, and other white articles, to which this objection does not apply; and that the addition of the flax to the cotton, though it somewhat increases the expence, adds so much to the durability of the article produced, as to make his invention a considerable improvement in manufacture, which well deserves trial from the public.

***Patent of* THOMAS MARSH, *of King-street, Clerkenwell, Watchmaker, for Improvements in the Construction of Watches. Dated Sept.* 1811.—*Repertory of Arts, No.* 121.**

MR. MARSH describes his invention in the following words: "the wheel being first made of brass or steel, with a broad edge equally divided, and the upper edge to be cut with a common tooth; when so cut, to have one or more teeth taken out for the pinion to vibrate free in every given distance; the train proposed requires the other set of teeth sloped off to a point, suitable to lock on a pallet, or pass through the notch of a roller."

If any one can extract a meaning from the above specification, (which is purposely copied exactly in the words of the patentee,) we must yield the palm to him in the art of solving enigmas, for to us it presents nothing but a confused mass of bad English, false grammar, and unexplained allusions. Some hundreds of specifications of patents have been read and studied by the writer, but he never met one which completely baffled him before; and though the subject of clock-work is one on which he has taken pains to know all that has been published for some years; yet he cannot even imagine, or invent a meaning for the words of the patentee; nor can he conjecture what could be the object of the patentee in putting himself to the expence of taking this patent, unless he wished to have the name of being a patentee at all events, and to have the privilege of putting the king's arms over his shop.

Observations.—A person who takes a patent should recollect, that it is perfectly useless, unless he describes his invention so that it can be executed by others.

Patent of HENRY JAMES *and* JOHN JONES, *of Birmingham, for an Improvement in the Manufacture of Barrels of all Descriptions of Fire-Arms and Artillery. Dated July* 1811. —*Repertory of Arts, No.* 119, *Second Series.*

THE improvements, which are the objects of this patent, are of two descriptions, the first relating to the forging of the barrels, and the second to the turning and finishing.

The forging is performed by taking a skelp, or piece of iron prepared for making barrels for fire-arms, after being brought into a proper form for welding, heating it in a reverberating furnace, contrived to give a welding heat to half the barrel at a time, putting the mandril expeditiously into it, and placing it on an anvil grooved to fit its form, upon which several hammers, ranged side by side, as true and close together as possible, and covering a space about twenty inches long and four or five broad, are made to fall, by a mill or engine, nearly together, or in rapid succession. Six hammers are sufficient for barrels between three and four feet long; but the number and weight of the hammers should be varied according to the description of barrels required; and their faces may be hollowed out a little where they fall upon the barrel. The welding may also be performed by a pair of rollers grooved to fit the form of the barrel; but the hammers make the soundest and most perfect barrels. Care should be taken in either way that the edges of the skelp be placed true together, that the iron receives a regular welding heat, and that the mandril be put into, and taken out from the barrel as quickly as possible. If the mandril should adhere so that it cannot be struck out from the barrel while it is hot; then, after being left to cool, the barrel should be lightly hammered, which will cause it to expand a little, and permit the mandril to come out. By heating the barrels in a hollow fire or reverberating furnace, cinders, or ashes, are prevented from getting into them or between the welding seams; which, added to the mode of welding by numerous hammers, causes the work to be sounder and more accurately made, as well as to be formed more expeditiously.

The apparatus for turning the barrels, after they are forged, is formed by three horizontal bars, between four and five feet long, eight or nine inches broad, and two or three inches thick, two of which are placed opposite to each other about five inches apart, in the same plane with the barrel when fixed ready for turning in the lathe; and the third bar is placed edgewise over the barrel, about five inches above the level of the two other bars: the edges of these bars, next the barrel, are formed to correspond with the exact taper, or shape, which the barrel is required to have when finished. On each of these bars a sliding carriage, or frame, is adapted, to which

the turning tools, or cutters, are secured, and adjusted, by screws. The carriage is made to move along the bar very true and steady, and is guided in its direction by the edge of the bar which corresponds to the form of the barrel. After forging and welding, the black barrel should be first bored, and then be set as straight as possible for turning; it is after this fitted fast on a steel mandril so as not to move round it; the ends of which mandril are made to work in the lathe, either on centers, or with *journeys* and collars, the latter of which are preferred by the patentees. The mandril with the barrel on it, is placed in the lathe in nearly a central horizontal line with the three inner edges of the bars, which correspond to the form of the barrel when finished, and is there turned by a spindle, which, as occasion requires, is thrown in or out of gear. The sliding carriages are made to move on the bars by long horizontal screws turned by the machinery, two or more cutters are fixed on each carriage, and bearers or guides are made to move with the carriages, so as to press against the side of the barrel opposite to the cutters, a little behind the place where they act, in order to keep the barrel steady, and prevent it from vibrating or springing from the cutters, as it otherwise would do. The patentees find that they turn the barrels very true and perfect, ready for filing, by one roughing tool or cutter, and one finishing tool passing over it once, thus roughing and finishing at the same operation, without having any occasion to use grinding stones, with which they wish to dispense altogether.

Barrels may be turned by the use of one bar and sliding carriage, but the patentees prefer the number mentioned, on account of their keeping the work more steady, and consequently finishing it more evenly. The lathe and other machinery may be made of cast-iron, or other metal or substance most proper for their construction.

The patentees state, that by this mode of turning barrels, one skilful foreman and an assistant may attend three, four, or more turning lathes, and finish a much greater number of barrels fit for filing, in a much more true and perfect state, than can be done by grinding, or any other mode now in use, with the same proportion of power and manual labour. The superiority of this mode of finishing over that by grinding, arises first from the great difficulty there is in grinding barrels equally, one side of the barrel being often left after grinding, twice the thickness of the other side; which renders them very weak, and liable to burst. Secondly, from its being a very laborious, dangerous, and unwholesome operation; and thirdly, from its requiring a considerable expence for the grinding-stones; but the method recited, on the contrary, forms the barrels equally thick all round, by which means they are much stronger for the same weight of metal, and at the same time constitutes comparatively a safe, easy and wholesome employment.

Observations.—This method of making barrels appears to possess much excellence, and will, when it comes into the use it deserves, remove the bad character which barrels laboured under that came from those places where large quantities of them were made, and where much machinery of course was employed: it will also, from the good sound barrels it must produce, prevent many of those dangerous accidents that at present occur, from the bursting of barrels imperfectly welded and unevenly finished.

NATURAL PHILOSOPHY, ARTS, CHEMISTRY, AND MINERALOGY.

A Narrative of the Eruption of a Volcano in the Sea, off the Island of St. Michael. By S. TILLARD, *Esq. Captain in the Royal Navy.—Philosophical Transactions, Part I.* 1812.

THE author of this communication had the good fortune to see this magnificent natural phenomenon in full perfection from the island of St. Michael, from which it was scarcely a mile distant, and to witness the birth of a volcanic island rising gradually from the ocean by the accumulation of volcanic matter, which has certainly had the shortest political as well as physical existence of any in record, since it was formally taken possession of in King George's name whilst still hot and smoking, and (as we learn by the newspapers) has since returned beneath the bed of the ocean, "leaving not a wreck behind." Captain Tillard describes in the following striking manner the appearance of this volcano: "Imagine an immense body of smoke rising from the sea, which had the appearance of a circular cloud revolving on the water like an horizontal wheel in various and irregular involutions; when suddenly a column of the blackest cinders, ashes, and stones, would shoot up in form of a spire, in an angle of from ten to twenty degrees from the perpendicular, inclining to windward. This was succeeded by a second, a third, and a fourth, each acquiring greater velocity.

As the impetus with which the columns were severally propelled diminished, they broke into various branches, resembling a group of pines; these again forming themselves into festoons of white feathery smoke intermixed with the finest particles of falling ashes, which at one time assumed the appearance of innumerable plumes of black and white ostrich feathers surmounting each other; at another, that of the light wavy branches of the weeping willow.

During these bursts, the most vivid flashes of lightning conti-

nually issued from the densest part of the volcano, and the ascending smoke rolled off in large masses of fleecy clouds, expanding themselves before the wind in a direction nearly horizontal, and drawing up to them a quantity of water-spouts.

When the volcano was about four days old, a peak was observed above the surface of the water, which soon expanded itself into a complete crater of four or five hundred feet diameter.

Captain Tillard returned to the spot about three weeks after, when the island was nearly the height of Matlock High Tor, about eighty yards above the sea, and about a mile in circumference. The party landed with some difficulty, on account of the steepness of the sides and burning heat of the soil, the crater at that time discharging a stream of boiling sea-water, which it had doubtless sucked in at high tide. They succeeded in reaching the summit, where they performed the ceremony of taking possession of the island.

Many dead fish were found floating in the inlets and bays of the adjoining island of St. Michael.

***On a Gaseous Compound of Carbonic Oxyde and Chlorine. By* JOHN DAVY, *Esq.—Philosophical Transactions, Part I.* 1812.**

MESSRS. GAY LUSSAC and Thenard, and Mr. Murray, have both asserted that no chemical action takes place in a mixture of chlorine (*oxymuriatic gas*) and carbonic oxyde when exposed to solar light. Mr. John Davy, however, contradicts this assertion by the following experimental proof, in which a very powerful chemical action is found between these substances. Equal volumes of the two gasses (previously well dried) were mixed in an exhausted receiver with every precaution to exclude moisture, and after exposure to sunshine for a quarter of an hour, the colour of the chlorine had disappeared; and on admitting mercury, an absorption equal in volume to half the bulk of the gasses, took place, leaving the residual gas, which is the subject of this enquiry.

This compound gas has the following properties: it does not fume in the atmosphere, and it has a very pungent suffocating smell. It reddens litmus. It condenses four times its bulk of ammoniacal gas, forming a white salt perfectly neutral and decomposable by the stronger acids. When many of the metals are heated in this gas, the chlorine alone acts upon them, forming the *metallic butters*, and the carbonic oxyde remains uncharged.

Potassium, on the other hand, when heated in this gas, causes the precipitation of carbon, and therefore decomposes the carbonic oxyde as well as the chlorine. Sulphur and phosphorus sublime

in this mixed gas, without producing any change. The gas is rapidly decomposed in water, forming the carbonic and muriatic gasses.

From its reddening litmus, and forming a neutral salt with ammonia, Mr. Davy considers this compound to be an acid; and if the power of saturation be taken as the measure of affinity, its attraction for ammonia must be greater than that of any other substance, since no acid condenses so large a portion of this alkali. The specific gravity of this new gas (as inferred from that of its constituents, and from the condensation on mixture) is such, that 100 cubic inches weigh 105.97 grains.

When hydrogene, chlorine, and carbonic oxyde are mixed in equal volumes and exposed to light, both the new compound and muriatic gas are formed.

Experiments on the Combinations of different Metals and Chlorine. By JOHN DAVY, *Esq.—Philosophical Transactions, Part I.* 1812.

PROFESSOR Sir H. Davy having demonstrated, in his last Bakerian lecture, the existence of a class of bodies similar to metallic oxydes, but consisting of metals in union with chlorine or oxymuriatic acid, the subject has been pursued by Mr. John Davy in this experimental research, some particulars of which we shall give. We must premise, that the author begins by giving a new nomenclature to these compounds, and calls the metallic *oxymuriates* of combinations of *chlorine*, by a term, the root of which is the name of the metal, but with the termination *ane* or *anea*, according to the proportion of chlorine. Thus copper with a smaller portion of chlorine, he terms *cuprane*, and with a larger, *cupranea*. Iron with chlorine is *ferrane* or *ferranea*, &c.

Two combinations of chlorine and copper may be made directly, by the combustion of copper in chlorine gas. In this case, after the action is over, two substances are formed, one, with the inferior portion of chlorine (*cuprane*), which melts to the bottom of the vessel, and the other a sublimate (*cupranea*), which is yellowish brown. The former is convertible into the latter, by being heated with an additional portion of chlorine. Cuprane is also obtained by distilling two parts of corrosive sublimate, and one of copper filings. This compound was first discovered by Boyle, who called it *resin of copper*, from its resin-like appearance. Cuprane is the *white muriate of copper*, found by Proust to be formed by the action of muriate of tin on muriate of copper, and also by heating the deliquescent muriate of copper. Cuprane is fusible in a low red heat, and without decomposition, in a close

vessel. It dissolves in muriatic acid unaltered; but when heated with caustic alkali, it is decomposed, and the orange oxyde of copper is left.

Tin, like copper, combines with two proportions of chlorine; that in which chlorine is the greatest is the *liquor of Libavius*; the inferior proportion is obtained by heating an amalgam of tin and calomel, or by evaporating to dryness and fusing the submuriate of tin; this, when heated in chlorine gas, absorbs a fresh portion of it, and becomes Libavius' liquor or *Stannanea*. This liquor has the singular property of inflaming oil of turpentine when poured into it.

Iron also unites with chlorine in two proportions: the highest proportion is procured by the combustion of iron wire in chlorine gas, which gives a sublimate in small brilliant iridescent plates; the other is obtained by heating to fusion the green muriate of iron in a vessel nearly closed: it has a grey colour and a metallic splendour.

Manganese, lead, zinc, arsenic, antimony, and bismuth, have only furnished one proportion of combination with chlorine. The compound with manganese is obtained, as before, by fusing the white muriate in a closed vessel. This may be separated from iron by repeated fusion, which sublimes the salt of the latter metal and leaves the manganese pure.

The *butter of arsenic* or *arsenicane*, as our author would term it, may be formed either by burning metallic arsenic in chloric gas, or by distilling white arsenic and corrosive sublimate, or arsenic and calomel, or muriate of arsenic and sulphuric acid. Six parts of corrosive sublimate to one of arsenic are good proportions. The heat should be gentle. This fuming liquor of arsenic, when warm, dissolves phosphorus and sulphur: the latter in such quantity that much is deposited on cooling. The liquor also has a strong action on oils and resins. The resins are again separated by water.

There exists a great difference in the combinations of metals and chlorine in respect to volatility and fusibility, which bears no relation to the proportions in which the metals themselves possess these properties, and is entirely unaccountable. Some of these oxymuriates, such as that of arsenic and tin, do not become solid at a very low temperature. Mr. D. exposed them to 20° below 0, without producing their congelation.

The next subject in this paper treats of the relation between the proportion of oxygen and chlorine in combination with several metals. If the hypothesis of definite proportions in chemical combinations be correct, it affords a most valuable and simple method of examining the accuracy of chemical analyses. The author assumes as his standard experiment, that 1 part by weight of hydrogen unites with 7.5 of oxygen to form water, and with 33.6 of chlorine to form muriatic gas. Hence he assumes the numbers

7.5 to 33.6 as the relative proportions of oxygen and chlorine (oxymuriatic acid), which should unite with the same quantity of metallic base in forming the oxydes and corresponding oxymuriates.

It is not necessary to go over all Mr. D.'s calculations on this subject: many of them agree tolerably well with the actual results of his experiments; and where they differ materially, he gives his reasons for doubting, and his experiments for correcting, the proportions of oxygen in the metallic oxydes, as given by some of the best authorities.

Some experiments follow on the relation between the proportion of sulphur in the sulphurets, and of chlorine in some of the combinations of chlorine and the metals.

The paper concludes with a few and imperfect experiments on the solubility of the oxymuriates in muriatic acid.

Observations.—It is not with a view of detracting from the merit of the author of this paper that we remark, that it bears on the first examination the appearance of greater originality than really belongs to it. The total change of nomenclature, the uniform exclusion of the accustomed terms, and the already-acquired habit of explaining every phenomenon by Professor Davy's theory concerning muriatic acid, would for a moment make us forget, that most of the substances and compounds which the author here examines, have long been under the hands of many of the ablest chemists. There are, however, some new and many valuable experiments related in this paper, but some facts are stated in direct contradiction to the observations of other chemists, as for example, where it is asserted that aurum musivum gives no sulphureous gas when heated. Notwithstanding the prolixity to which minute chemical detail is liable, we wish the author had more enlarged on his methods of operating, for (as he himself observes) errors are common even in the most skilful chemical analyses, and it is only by minute description that the chemical reader can examine with any profit the relation of experiments that are to be the bases of elementary calculations.

On the Primitive Crystals of Carbonate of Lime, Bitter Spar, and Iron Spar. *By* WILLIAM HYDE WOLLASTON, *M. D. Secretary to the Royal Society.—Phil. Trans. Part I.* 1812.

In the Traité de Mineralogie of the celebrated crystallographist Abbé Haüy, the same primitive form is assigned to three substances very different in their composition, namely, carbonate of lime, bitter spar, and carbonate of iron. It has been objected to Haüy, that according to his method, identity of form should be

accompanied by identity of composition, unless the form were one of the common regular solids. Dr. Wollaston, by employing the more accurate mode of measurement by his goniometer, has here furnished an answer to this objection to the Abbé's theory, by demonstrating a very sensible difference in the angles of these three dissimilar substances, that of carbonate of lime being 105° 5′, of bitter spar being $106\frac{1}{4}°$, and of carbonate of iron 107°. The author suggests the probability, that when substances, which agree very nearly in their primitive angle, are intermixed in certain proportions, they may each exert their power, and may occasion that confused crystallization with curved surfaces as is seen in the pearl spar.

Chemical Researches on the Blood and some other Animal Fluids. *By* WILLIAM THOMAS BRANDE, *Esq. F. R. S.—Phil. Trans. Part I.* 1812.

THE object of these experiments was, to ascertain the nature of the colouring matter of the blood, and at the same time to compare the composition of chyle and lymph with that of blood. The following is a short abstract of these interesting experiments:

Analysis of Chyle.—The fluid contained in the thoracic duct of any animal about four hours after taking food, may be considered as pure chyle, and it was this which was selected for experiment. At a longer period after a meal, the chyle is less milky; and after fasting four-and-twenty hours, it is mere lymph. The chyle here examined was white, without smell, sweetish, and slightly saline to the taste; neither litmus nor turmeric colours are changed by it, but syrup of violets becomes slowly green.

In about ten minutes after removal from the duct it becomes a stiff jelly, and after some hours spontaneously separates, like blood, into a serum and crassamentum.

The coagulated portion or crassamentum of chyle much resembles the curd of milk. The fixed alkalies, both caustic and carbonated, dissolve it with the evolution of ammonia: ammonia also dissolves it. From these alkaline solutions all acids separate a substance intermediate between fat and albumen, and an excess of them re-dissolves this substance. Neither alcohol nor ether act upon the crassamentum of chyle, but they dissolve the coagulum or precipitate from its alkaline solution.

When the coagulum of chyle is dissolved in dilute sulphuric acid with the assistance of heat, the alkalies no longer separate it, but infusion of galls produces a separation.

Weak nitric acid long digested upon the coagulum changes it to adipocire. When the acid is more concentrated, it dissolves a por-

tion, and converts it to gelatine. On applying heat, the action is still stronger, and the carbonic and oxalic acids are generated.

The serum of chyle becomes turbid when heated, and deposits albumen. The remaining *serosity* or fluid part, when slowly evaporated, deposits small crystals resembling sugar of milk.

Analysis of Lymph.—The author considers as pure lymph, that fluid which is found in the thoracic duct of an animal after twenty-four hours' fasting. This fluid is miscible with water in every proportion, produces no change on vegetable colours, is not coagulated by heat nor acids, and is only made slightly turbid by alcohol. When evaporated to dryness, the residuum is very small and slightly alkaline, and on complete incineration contains an atom of common salt but no trace of iron. When lymph is submitted to the action of a galvanic battery, the negative surface evolves an alkali, and portions of coagulated albumen are separated. The positive surface appears to evolve only muriatic acid.

Analysis of the Serum of Blood.—The chief point with the author was, to ascertain whether the substance which remains in the fluid part of coagulated serum (or *serosity* as it is called), and which causes it to gelatinate on evaporation, is really *gelatine*, or only a portion of albumen rendered soluble, and prevented from coagulation by means of the alkali contained in this fluid. To ascertain this, the author made the happy application of the galvanic action in the manner in which he had employed it on former occasions. Some pure serum was coagulated by heat, and the coagulum digested in water, to dissolve all the still fluid portion. A part of this latter, when slowly evaporated, afforded a sort of jelly on cooling, which would lead to infer the existence of gelatine, but on submitting another portion of this serosity to the galvanic action, a rapid coagulation took place, and after this was over, no gelatinizing substance whatever remained. On the other hand, the author found by comparative experiments, that *real gelatine* is not coagulated by the galvanic action, either when alone or in company with albumen; and hence, as all the gelatinizing matter of serum is coagulated by galvanism, it would follow that this matter is not gelatine, but such a modification of albumen as to be uncoagulable by heat alone.

A very slight trace only of iron exists in the incinerated residue of evaporated serum.

Coagulum of the Blood.—Mr. Hatchett having shewn in his researches on albumen, that this substance (which when coagulated is identical with fibrina) contains hardly an appretiable portion of iron, it must follow, that if this metal gives the colour to blood, it must be contained in the colouring globules. To ascertain this, two portions of blood were taken, one of which was allowed to coagulate spontaneously, and the other was stirred with a stick constantly

during coagulation, by which (as is well known) the greater part of the fibrina collects round the stick, carrying with it but little of the colouring matter, which last therefore remains behind in the residue. These two portions of coagulum (one with colour and the other without) were dried, and equal weights calcined, but the iron extracted from the ashes was not perceptibly greater in one portion than in the other.

Again, the colouring matter of a pint of blood was collected by itself, dried, and calcined, but the traces of iron were very small and indistinct.

Colouring Matter of the Blood, or Red Globules.—This is procured by stirring venous blood during coagulation, whereby the fibrina is separated and the colouring matter is diffused through the serum, from which it subsides by rest, and may be chiefly separated by decantation. Water dissolves this colouring matter, but the solution is decomposed at a boiling heat; the colour is precipitated, and the water remains clear.

Muriatic acid dissolves only a part of the colouring matter. It is prepared by digesting the coagulum of blood in equal parts of muriatic acid and water at the heat of 150° to 200°. The solution is crimson when viewed by reflected light, but by transmitted light it is green, which is more distinguishable as the solution is more diluted. It is not decomposed by heat, nor by infusion of galls, nor by the alkalies, caustic or carbonated.

Dilute sulphuric acid and acetic acid, make a solution of the colouring matter with equal ease and of equal permanency. The nitric acid on the other hand decomposes it. The alkalies, pure and carbonated, also dissolve it with equal ease, forming crimson red liquors.

The action of many of the usual mordants for vegetable and animal colouring matter was then tried. Alumine does not succeed in forming a permanent compound with the colour. Oxyde of tin answers rather better, but still imperfectly. Infusion of galls and oak bark do not succeed. With corrosive sublimate and nitrate of mercury the author was enabled to fix a red colour on cloth, unalterable by soap.

The general results of this valuable memoir are,

That gelatine is not contained in blood, and therefore must be a product of secretion.

That the proportion of iron in blood is extremely small, and not more in the colouring matter than in the albumen; from this, as well as other circumstances, it is highly probable, that this metal does not give the red colour to blood: and,

That the colouring matter is a peculiar substance little altered by acids or alkalies, which has a strong affinity with some mordants; and hence may probably be applied to the use of the manufacturer.

On the Manufacture of Soda. By J. C. DELAMETHERIE.—*Journ. de Physique, Vol.* 69.

MANY of the correspondents of M. Delametherie having requested of him an account of the processes that have been followed for the preparation of soda from Glauber's salt, he here publishes two extracts, one from a memoir of M. Leblanc, which appeared in the year 1798, and the other from the Journal de Physique for 1789, in which a method is proposed, which has been fully proved to be in part inadequate to the end, and in part inadmissible, from its expence. The plan, in few words, is the following. Common salt is to be decomposed by sulphuric acid: the muriatic acid hence resulting is to be employed in bleacheries and sal ammoniac manufactures; and the sulphate of soda is to be mixed with charcoal, and then exposed to a high heat in large retorts, by which the sulphuric acid will be converted into the sulphurous, and this last being driven off by the heat into a close chamber, is there to be reconverted into sulphuric acid, and the contents of the retorts will be found to be soda mixed with charcoal. If any sulphur should be retained by the alkali, it may be separated by combining the alkali with vinegar, filtering the liquor, boiling it down, incinerating it, and, finally, again lixiviating the calcined mass.

Of this process the former part is a mere romance: charcoal will convert the sulphuric acid partly into sulphurous acid, and partly into sulphur; but neither the one nor the other will be driven off by the heat: the subsequent addition of vinegar will separate some of the sulphur, but the remainder, combined with sulphurous acid and the alkali into a triple salt, can only be got rid of by repeating several times the calcination and combination with vinegar.

On Phosphorescence. By J. P. DESSAIGNES.—*Journ. de Physique, Feb.* 1810.

THE author begins by showing, that of those substances which emit phosphoric light by a degree of heat inferior to ignition, a large class exhibit this property in consequence of water interposed between the particles or laminæ of which they are formed; that this phosphorescence lasts only during the volatilization of the water, ceases when the water is entirely exhaled, and may be renewed by immersing them while heated, in water. This theory he further illustrates by a striking fact relative to Parian marble. Most of the granular limestones decrepitate more or less by sudden exposure to heat, in consequence of the rapid volatilization of their water, and are also phosphorescent by a gentle heat: Parian marble,

on the contrary, undergoes no decrepitation, therefore contains no water, and is not capable of being rendered phosphorescent by heat.

With regard to those transparent solids that contain *combined* water, and are not naturally phosphorescent, such as adularia, if by calcination they can be rendered opake, they also acquire the property of phosphorescence, because, according to M. Dessaignes, part of the water which was before combined, is now merely interposed. Those unphosphorescent substances which retain their transparency after exposure to ignition, such as aquamarine, topaz, and Madagascar rock crystal, are not capable of being rendered phosphorescent by mere heat.

M. Dessaignes then passes to the consideration of the influence of points or roughened surfaces in disposing a body to become phosphorescent. He remarks, that a colourless cube of fluor spar, the surfaces of which still retain their natural polish, does not become phosphorescent by heat, but that, if the edges, solid angles, or faces, are either fractured or rubbed on a rough stone, the parts so fractured and roughened give out a bright light on being heated. The same is the case with limpid adularia, Madagascar crystal, and vitreous phosphate of lime. M. Dessaignes accounts for this difference, by supposing that the phosphorescent fluid is able to escape, and thus become visible, between the crystalline laminæ, but not through or across them, and, in confirmation of this theory, he finds that a section parallel to the natural joints of a crystal has no effect in disposing the substance, thus fractured, to become phosphorescent. Finally, he applies this theory so as to account in a plausible manner at least, for the remarkable difference observed between different specimens of diamonds with regard to their phosphorescence. Those diamonds which exhibit the form of the primitive octohedron, are not phosphorescent so long as their figure remains unaltered; but, if broken to pieces, or if cut in any direction, except perfectly parallel to the sides of the primitive figure, they become phosphorescent in consequence of the exposure of the edges of their crystalline plates.

M. Dessaignes concludes this paper by showing, that the phosphorescence excited by exposure to the rays of the sun, or *insolation*, follows nearly the same laws as phosphorescence from heat does.

Some further Remarks on Phosphorescence by Insolation. By J. P. DESSAIGNES.—*Journ. de Phys. Nov.* 1810.

M. DESSAIGNES does not seem to be acquainted with Mr. Wilson's very interesting treatise on "Solar Phosphori;" otherwise he would not have hazarded the inartificial experiments and crude remarks contained in this paper, and which we have therefore omitted to detail to our readers.

On the Nature of Potash and of Oxygenated Muriatic Acid. *By* M. HEINEKEN.—*Journ. de Phys. Feb.* 1810.

THE author of this notice informs us that he passed the galvanic fluid through a solution of pure carbonate of potash: at the end of four or five days the liquid in contact with the negative pole had acquired a golden yellow colour, and exhaled a very decided odour of oxymuriatic acid; the presence of this acid in the liquor was further proved by its forming a curdy precipitate with the nitrates of silver and of mercury, and by entirely discharging the colour of blue tincture of tourneval and of common ink. The liquid in contact with the positive pole was very caustic. From the above experiment the author concludes, that potash and oxygenated muriatic acid are each composed of carbon, hydrogen, and oxygen, differing only in the relative proportion of the ingredients.

Observations.—Upon this paltry experiment, and the nonsensical conclusions attempted to be drawn from it, no reliance can possibly be placed, inconsistent as it is with the most elaborate and trustworthy experiments of the English, French, and Swedish philosophers.

Facts illustrative of the History of Gunpowder. *By* L. J. PROUST.—*Journ. de Phys. April,* 1810.

THE troubles in Spain put an abrupt period to the services of this excellent chemist, under the late regal government of that country, and at the same time interrupted in their very commencement, a series of experiments on the composition and properties of gunpowder, which his connexion with the ordnance department of Spain induced him to enter upon. Summoned to Paris, and there suffering, as we have been informed, at an advanced age, the combined pressure of poverty and neglect, there is little probability of his labours on the subject before us being ever resumed. The present experiments must therefore, in common candour, be considered merely as fragments, tending to illustrate the modifications in the combustion of mixtures of charcoal and nitre, according to the kind of wood from which the charcoal is procured, a subject, the importance of which has always been acknowledged by the manufacturer, though it has never yet been made a matter of scientific investigation.

The different charcoals hereafter mentioned were procured by distillation at a red heat, and were mixed with the same proportions of nitre as nearly as possible under the same circumstances.

For this purpose an ounce, or an ounce and a half of nitre, finely pulverized and thoroughly dried, was put into a large bell-metal mortar with one-fifth of its weight of the charcoal under examination, and the whole was carefully mixed by beating for the space of six hours, a few drops of water being added from time to time, just sufficient to prevent the powder from flying. The mass thus obtained was then folded up in paper and dried on a shovel, or in a stove. In order to ascertain the most obvious phenomena attending the combustion of the powders thus prepared, a number of small cylindrical tubes of equal bore, made of sheet brass, were procured, and the combustion was performed in the following manner. One of the tubes being charged with 72 grains of the powder, firmly rammed down, was fixed in a hole passing through a piece of cork, in such a manner as to float in water with its mouth a few lines above the surface of the fluid: in this position the surface of the powder was touched with a match, and the duration of its combustion was noted by means of a second pendulum; such experiment was repeated three or four times, and the result is contained in the following table:—

Nitre 60 grains.		*Time of combustion.*		*Residue in the tubes.*
		grs.	seconds.	grs.
	The charcoal of Asphodel stalks	12	10	12
	——— hemp-stalks	—	10	12
	——— vine-cuttings	—	12	20
	——— stalks of peas	—	13	21
	——— fir-wood	—	17	30
	——— peach-tree	—	20	24
	——— spindle-tree	—	21	27
	——— hazel-wood	—	23	33
	——— maize-stalks	—	25	38
	——— chesnut-wood	—	26	36
	——— walnut-wood	—	29	33
	——— carbonaceous residue of alkohol after the preparation of sulphuric æther	—	36	44
	——— grains of maize	—	55	43
	——— pit-coal	—	50	45
	——— sugar	—	70	48

From this table it appears that the light woods, and especially the stalks of succulent vegetables, are the best suited to produce that rapidity of combustion which is one of the main circumstances on which the efficacy of gunpowder depends. It is also evident, that the more rapid the combustion, the smaller in general is the residue

left in the tube, and therefore, that the strongest powder is that also which has the least tendency to foul or clog the fire-arms in which it is used. It appears also, that the more elaborate and compounded vegetable products are those which detonate the most slowly, a conclusion which is still further confirmed by the following list of charcoals, which, when treated as above-mentioned, do not detonate at all, the combustion being immediately extinguished by the alkali of the decomposed nitre. These are the charcoals of starch, of wheat, of rice, of gall-nuts, of lignum vitæ, of heath, of indigo, of gluten of wheat, of glue, of white of egg, of human blood, of ox hide.

Here unfortunately terminate the experiments of M. Proust, and we sincerely hope that some other competent person may be induced to take up an enquiry which promises to throw so much light on the theory of gunpowder, and will probably suggest many improvements in its preparation. Is it not probable that those charcoals which contain the largest proportion of hydrogen and the smallest of other ingredients, are the best fitted to produce that sudden expansion on which the projectile force of gunpowder essentially depends?

Chemical Researches into the Nature of Minerals. By M. H. KLAPROTH.—*Journ. de Phys. Aug.* 1810.

THE following paper contains the results of those chemical analyses that are to be found in the last (the 4th) volume of the Analytical Essays of Klaproth.

Analysis of *Electrum.*

Among other meanings of the word Electrum, we find it used by Pliny, to distinguish those varieties of native gold, which contain at least one-fifth of silver. The gold mine of Schlaugenberg, in Siberia, affords an alloy, the component parts of which appear from analysis to be,

64. Gold.
36. Silver.

100

Analysis of *Pacos.*

Certain varieties of the silver ores of Peru are known by the name Pacos. As peeimen presented to Klaproth by Humboldt afforded,

14. Silver.
71. Brown oxyde of iron.
3.5 Silex.
1.0 Sand.
8.5 Water.

98.0
2.0 loss.

Analysis of *Native Cinnabar* from Japan.

84.5 Mercury.
14.75 Sulphur.

99.25
0.75 loss.

The cinnabar of Neumarkettel in Carinthia, afforded the same result.

Analysis of the *Hepatic Cinnabar* of Idria.

818. Mercury.
137.5 Sulphur.
23. Charcoal.
6.5 Silex.
5.5 Alumine.
2.0 Oxide of iron.
0.2 Copper.
7.3 Water.

1000.0

Analysis of the *lamellar Red Copper* of Siberia.

91. Copper.
9. Oxygen.

100

Analysis of the *Kupferlazur,* or Mountain Blue of Siberia.

56. Copper.
14. Oxygen.
24. Carbonic acid.
6. Water.

100

Analysis of the *Kuppergrun*, or Mountain-green of Siberia.

40. Copper.
10. Oxygen.
7. Carbonic acid.
26. Silex.
17. Water.

100

Analysis of Vitreous Copper Ore.

76.5 Copper.
0.5 Iron.
22. Sulphur.

99
1.0 loss.

Analysis of three specimens of Fahlerz, from Freyberg.

41.	48.	42.	Copper.
0.4	0.5	0.9	Silver.
22.5	25.5	27.5	Iron.
24.1	14.0	15.6	Arsenic.
10.	10.	10.	Sulphur.
		1.5	Antimony.
98.0	98.0	97.5	

Analysis of *Graugultizer*.

Crystallized, from Kaprick.	Massive, from Poratsch.	Massive, from Annaberg.	Crystallized, from Zilla.	From Wolfach.	Massive, from Peru.	
37.75	39.	40.25	37.5	25.5	27.	Copper.
22.	19.5	23.	29.	27.	23.5	Antimony.
5.	0.	0.	0.	0.	0.	Zinc.
3.23	7.5	13.5	6.5	7.	7.	Iron.
28.	26.	18.5	21.5	25.5	27.75	Sulphur.
0.25	0.	0.3	3.	13.25	10.25	Silver.
0.	6.25	0.	0.	0.	0.	Mercury.
0.	0.	0.75	0.	0.	0.	Arsenick.
—	—	—	—	—	1.75	Lead.
96.23	98.25	96.3	97.5	98.25		

Analysis of *Antimonial Lead Ore.*

From Andreasberg.		*From Nansle, in Cornwall.*	
34.5	.....	39.	Lead.
16.	.....	28.5	Antimony.
16.25	.....	13.5	Copper.
13.75	.....	1.	Iron.
2.25	.....	0.	Silver.
13.5	.....	16.	Sulphur.
2.5	.....	0.	Silex.
98.75	.....	98.0	

Analysis of *Bismuthic Copper Ore* from Wittichen.

47.24 Bismuth.
34.66 Copper.
12.58 Sulphur.

94.48

Analysis of the *Native Iron* in a Meteorolite from Agrau.

96.5 Iron.
3.5 Nickel.

100

Analysis of *Native Iron* from St. John, near Grosskansdorf, in Saxony.

92.5 Iron.
6. Lead.
1.5 Copper.

100.0

Analysis of *Spathose Iron.*

From Danberode, in Halberstadt.		*From Baireuth.*	
57.5	.....	58.	Oxyde of iron.
3.5	.....	4.25	Oxyde of manganese.
1.25	.....	0.5	Lime.
0.	.....	0.75	Magnesia.
36.	.....	35.	Carbonic acid.
98.25	.....	98.5	

Analysis of the *Blue Ferruginous Earth* of Ekartzberg.

47.5 Oxyde of iron.
32. Phosphoric acid.
20. Water.

99.5

Analysis *Meadow Iron Ore.*

66. Oxyde of iron.
1.5 Oxyde of iron.
8. Phosphoric acid.
23. Water.

98.5

Analysis of the *Pea-shaped Iron Ore* of Hagau.

53. Oxyde of iron.
23. Silex.
6.5 Alumine.
1. Manganese.
14.5 Water.

98.0

Analysis of the *Granular Chromate of Iron* of Styria.

55.5 Oxyde of chrome.
33. Oxyde of iron.
6. Alumine.
2. Silex.
2. Volatile matter.

98.5

Analysis of the *Black Oxyde of Manganese* from Klapperud, in Dalecarlia.

60. Oxyde of manganese.
25. Silex.
13. Water.

98.

Analysis of the *Cerite* of Bastuaes, in Sweden.

54.5	Oxyde of cerium.
34.5	Silex.
3.5	Oxyde of iron.
1.25	Lime.
5.	Water.
98.75	

Analysis of a fine-coloured Opal, brought from Zunapan, in Mexico, by M. Humboldt.

92.	Silex.
7.75	Water.
0.25	Oxide of iron.
100.0	

Analysis of *Topaz.*

Brasilian.		*Saxon.*	
44.5	.....	35.0	Silex
47.5	.....	59.0	Alumine.
7.0	.....	5.0	Fluoric acid.
0.5	.....	a trace.	Oxyde of iron.
99.5	.....	99.0	

Analysis of *Crystallized Zaisite.*

45.	Silex.
29.	Alumine.
21.	Lime.
3.	Oxyde of iron.
98	

Analysis of *Angite.*

Lamellar from Carniola.		*Scoriform from Sicily.*	
52.5	.....	55.	Silex.
12.5	.....	1.75	Magnesia.
9.0	.....	10.	Lime.
7.27	.....	16.5	Alumine.
16.25	.....	13.75	Oxyde of iron.
0.5	.....	0.	Potash.
.0	.....	1.5	Water.
98.02	.....	98.5	

Analysis of *Apatite.*

53.73	Lime
46.25	Phosphoric acid.
99.98	

Analysis of *Columnar Brown Spar* from Valenciana de Guanaxuato, in Mexico.

51.50	Carbonate of lime.
32.	Carbonate of magnesia.
7.5	Carbonate of iron.
2.	Carbonate of manganese.
5.	Water.
98.0	

Analysis of *Dolomite.*

From St. Gothard.	*From the Appenines.*	
52.	59.	Carbonate of lime.
46.5	40.5	Carbonate of magnesia.
0.5	—	Oxyde of iron.
0.25	—	Oxyde of manganese.
99.25	99.5	

Analysis of *Anhydrite.*

Blue Var, from Sulz, on the Neckar.	*Compact Var, from Bochnia.*	*From Hall, in Tyrol.*	
42.	42.	41.75	Lime.
57.	56.5	55.	Sulphuric acid.
0.1	—	—	Oxyde of iron.
0.25	—	—	Silex.
0.	0.25	1.	Common salt.
99.35	98.3	97.75	

On the Preservation of Zoological Specimens. *By* M. M. Peron *and* Le Sueur. *Journ. de Phys. October*, 1810.

The two naturalists, whose names are prefixed to this memoir, were employed by the French government, in some of their recent circumnavigatory expeditions, for the purpose of collecting zoological specimens for the use of the museum. Having lost, by various accidents, in the early part of the voyage, a large proportion

of the very scanty supply of materials and vessels with which they were furnished, the success of the expedition, as far as this department was concerned, was left mainly to depend on their prudence in husbanding the resources which yet remained, and on their skill and knowledge in the discovery and judicious application of the most efficacious substitutes. The success which crowned their endeavours, is an ample testimony of their zeal and ability; and the result of their practical experience is contained in the present memoir.

1. *On the proper Vessels for containing Zoological Specimens.*

1. Casks and other wooden vessels have the advantage of being less fragile than any others, and not particularly heavy; but in return, the objections to their use are very serious. In the first place, the alcohol acquires from the wood a deep brown colour, which it soon communicates to the specimens immersed in it. Secondly, the colouring matter renders the alcohol less capable of counteracting the tendency of the specimens to putrefaction, especially in tropical climates. Thirdly, whatever care is taken in closing the vessels, it is impossible to prevent evaporation; and therefore it is necessary occasionally to open the packages for the purpose of adding fresh alcohol, by which a great loss is suffered, both of time and spirit. Fourthly, leakage is by no means uncommon, and, therefore, without a constant vigilant inspection, a multitude of specimens will infallibly be ruined.

2. Earthen vessels, if sufficiently compact to prevent the transudation of alcohol, are equally costly with glass, are heavier, and have the further disadvantage of being opake.

3. Glass, therefore, upon the whole, combines more advantages and avoids more inconveniences than any other material for vessels; the capacity of which does not exceed two gallons. The larger ones should be of a rectangular shape, approaching to cubical, for specimens of the Mammalia, and more and more elongated for fishes and reptiles; these should be made of green glass, as cheaper and more tough; the smaller vials, of the capacity of a few ounces, should be of white glass.

2. *Method of closing the Vessels.*

In order to obtain complete success in this very important particular, it is necessary that the method made use of should be simple and cheap, and that the materials should be easily procurable, not readily soluble in alcohol, capable of adhering firmly to the polished surface of glass, and of such a degree of toughness and hardness as to resist the shock of the contents of the vessel, when put in motion by the rolling of the ship in the most violent storms. All these objects are answered by the employment of sound corks and a lute composed in the following manner.

Take common resin and yellow bees'-wax, equal weights, and melt them together, then add successive portions of colcothar (levigated red oxyde of iron) till the composition, on dropping a little of it on a plate or piece of glass, has acquired a sufficient degree of hardness, then boil the mixture for a quarter of an hour, and temper it by the addition of common oil of turpentine. Having thus prepared the cement, proceed to close the vessel by selecting a proper cork, wiping it dry, and dipping it in the melted cement: drive in the cork thus prepared while the cement is still soft, and pour a sufficient quantity of the same cement over the cork to close completely every orifice; then, for the further security of the cork, tie it down by a cross ligature in the same manner as bottles of cyder are wired, and cover the whole with a piece of cotton or linen cloth well soaked in boiling pitch. This for the larger vessels; for the smaller vials, it is sufficient, after the cork has been put in, to invert and dip them up to the neck in the melted cement three or four times, till the cork is thus covered with a coating of sufficient thickness.

3. *On the different Kinds of Liquors in which the Specimens are to be immersed.*

The employment of a solution of corrosive sublimate is very properly objected to, on account of the extreme hazard of serious mischief to the naturalist who, in adjusting the package of his specimens, and in removing them from one vessel to another, is obliged repeatedly to plunge his hands into the liquor in which they are contained.

A solution of alum, at least in hot climates, will not prevent speedy putrefaction, and therefore cannot be employed.

A saturated solution of common salt is not much more efficacious: salt in substance answers better, and may be used for such skins and large specimens as are obliged to be packed in casks.

Vinegar is a much more efficacious preservative, especially if made into a pickle by the addition of a considerable quantity of red pepper and as much salt as it can take up.

But, upon the whole, the preference is to be given to alcoholic liquors, when used with judgment. Pure alcohol, in a short time, destroys the colour, and injures the texture of those animal substances which are immersed in it, and therefore as weak a spirit as possible is to be used, consistently with the great object of preserving the specimens from putrefaction. It is found also, by experience, that rum, or common distilled spirit, is less injurious than a rectified alcohol diluted to an equal degree of strength: the addition of a little camphor increases the preservative quality of the spirit, without producing any material bad effects.

But, notwithstanding the liquor, the vessel, and the manner of closing it, are all perfect in their kind, much care is still requisite

in the previous preparation of the specimen itself, in order to avoid the most mortifying losses.

The external surface of fish, of most reptiles, and of many other animals, is covered by a mucus coagulable by spirit of wine, and which, therefore, very materially impedes the free contact of the liquor with the specimen immersed in it. The first thing, therefore, to be done is, by means of a soft brush charged with water, vinegar, or spirit, carefully to remove all external mucus. The next object is to get rid of the main focus of putrefaction, by evacuating the contents of the stomach and intestinal canal: this is effected by washing out all these matters by repeated injections of water, and then getting out the water itself by suspension and gentle pressure. These preliminaries being duly performed, the stomach and intestinal canal are to be filled by injection with a highly camphorated alcoholic liquor, and the specimen is to be immersed, and at the same time kept suspended in weak spirit by means of pieces or elastic rings of cork.

Observations.—This memoir will prove a most useful *vade mecum* to all zoologists who may be employed in collecting specimens in tropical climates: every part of it is worthy of careful study, but the practice of injections, and of suspending the specimens by means of cork, are worthy of especial notice.

Report made to the Society for the Encouragement of National Industry, on Cast-Steel and several other Varieties of Steel. By M. Gillet de Laumont.—*Journ. des Mines, No.* 151.

The Society for the Encouragement of National Industry had proposed, in the year 1807, a prize of 4000 francs for the manufacture of cast-steel of a quality equal to the best foreign fabrics. For this prize there were two competitors, one a foreigner settled on the Continent, who sent two samples; the one of common cast-steel, and the other of cast-steel capable of being welded. The quality of each of these samples was excellent, but, as the proofs of authenticity were not satisfactory, and the other conditions were not complied with, the judges excluded these samples from the competition. In all probability they were imported from England.

The other competitor was the partnership of M. M. Poucelet Kaunet, brothers, manufacturers of cast-steel and of files at Liege.

The steel of this manufactory is sold at Paris for nearly half the price of English steel; it was distributed among the principal cutlers of Paris accustomed to work on English steel; and, from the separate reports of each of these artists it appeared, 1. That it was capable of being perfectly forged; 2. That it could be welded

on iron, but not steel upon steel; 3. That its temper was excellent; 4. That the polish was not quite perfect. It is, however, to be observed, that the whole of this steel was made from French iron, and that the fuel used in the fusion and forging of the steel was pit-coal: so that, upon the whole, the manufacture is highly to the credit of the French iron and of the French artists, and will, no doubt, seriously interfere with the consumption of English steel on the Continent of Europe.

On the Resistance which Air experiences in passing through long Tubes: extracted from the Preface to M. Baader's Treatise on Blowing Machines.—Journ. des Mines, No. 152.

The fact here mentioned took place in England; and, as it is of great importance both in theory and practice, and has not yet received that notice from natural philosophers to which it is well entitled, we shall make no apology for presenting it to our readers.

It is well known to all the English iron-masters, that when air passes out of the same reservoir through tubes of equal diameter, but of unequal length (as when a single blowing machine supplies two or more furnaces) the shortest tube always delivers a much stronger blast of air than the longer, even if the difference of length between the two does not exceed ten or twelve feet.

The late Mr. Wilkinson made accidentally an extremely curious experiment on this subject, and the result of which is by no means accordant with those laws of pneumatics which have hitherto been laid down. Intending to work the blowing machine to one of his furnaces by a stream about a mile distant, he placed by the brook-side a large overshot wheel and the usual apparatus of a blowing machine: this he connected with the furnace by means of a strait line of cast-iron pipes, the length of which was about 5000 feet, and their interior diameter twelve inches. The machinery being completed, the water-wheel was set to work, and, to the surprise of all present, jets of air began to escape with great violence from the most minute orifices as well as from the safety-valve, while at the open end of the pipe adjacent to the furnace, there was no passage of air whatsoever, not enough to produce the slightest wavering of the flame of a candle. The orifices in the luting, through which the air had escaped, were then carefully closed, and the safety-valve itself was also fastened down; the wheel being then again set in motion, it was found in a short time to move more and more languidly, till at length, notwithstanding the abundance of water, it entirely stopped; the elasticity of the compressed air becoming equal to the whole moving force; yet, even at this time, no air escaped from the distant open end of the pipe. This unexpected circumstance induced the suspicion that the pipe

had, by some accident, become stopped; to ascertain which, a cat was turned in at the end nearest to the blowing machine, which soon after made its appearance at the other end, thus proving that there was no obstruction. No other visible cause of this remarkable occurrence presenting itself, Mr. Wilkinson began to suspect that it depended in part, at least, on the length of the pipe: he, therefore, drilled holes in the pipe at thirty feet distance, beginning at that end the furthest from the blowing machine. The first faint breath of air was perceived at the drill-hole 600 feet from the machine, which was found to increase as each hole was successively bored nearer and nearer to the machine.

It is to be regretted, adds M. Baader, that this great experiment was not completed, by fixing barometer tubes to the drill-holes; and thus ascertaining the ratio, according to which the density of the air contained in the pipe diminished.

Notice concerning an Instrument for the purpose of reducing Plans, Sections, &c. By M. DE LA CHABEAUSSIERE.—*Journ. des Mines, No.* 156.

THIS instrument is merely a wooden bevel-edged rule, at one end of which is a pin, or a hole for the reception of a pin. The edge of the rule is graduated to one-twentieth, or one-twenty-fifth of an inch, according to the degree of accuracy required in the instrument; and its length may be as great as can be conveniently managed.

For its application, suppose the object is to reduce a plan to one-third of its original dimensions. First, mark on the large plan all such points of intersection as are necessary for constructing the reduced plan, then fasten a sheet of paper on a table, and lay the plan on the same table adjacent to the blank paper. This being done, fix the pin, or pivot of the rule on the paper, in such a manner that the distance from the pin to the nearest part of the plan shall not be less than one-third of the whole length of the rule; then move the rule on its centre till the edge comes into contact with one of the intersections of the plan, observe its distance from the centre, and with a needle make a mark in the blank paper contiguous to the edge of the rule, and at one-third of the distance from the central pivot; then proceed in the same manner with all the other points.

Observations.—It is evident, that by following the method here laid down, the reduction of a plan is obtained on the same principles as by the Pentagraph.

On the Prevention of Damage by Lightning, in a Second Letter from Mr. BENJAMIN COOKE.—*Phil. Journ. No.* 142.

IN a former letter, this gentleman recommends a most gigantic project of erecting conductors over the whole island, as a preservative against lightning. The object of the present letter is to point out some defects in the usual construction, and to suggest some improvements. To correct in some degree, the defect produced by the rusting of the iron, he proposes that the upper end of the conductor should be of brass, and that the other portion which is of iron, should be not less than three quarters of an inch in diameter, and bound with brass wire, passing in a spiral direction from top to bottom.

Experiments on Muriatic Acid Gas. By J. MURRAY, *Lecturer on Chemistry, Edinburgh.—Phil. Journ. Vol.* 31, *No.* 142.

MR. MURRAY begins by stating in very clear terms, what are the chief points of controversy between himself and the Davy's, in the very interesting question relative to the nature of muriatic and oxymuriatic acid.

The common opinion which is defended by Mr. Murray, is, that oxymuriatic acid gas consists of muriatic and oxygen gasses, together with a portion of water, which is essential to the constitution of muriatic acid in the gaseous form. The theory advanced by Sir H. Davy is, that oxymuriatic acid is a substance hitherto undecompounded, (to which he gives the name of *Chlorine*), and that by its union with hydrogen it forms muriatic acid gas. There are two ways Mr. Murray observes, of examining this hypothesis experimentally; one is, to ascertain whether oxymuriatic gas contains oxygen; the other, whether muriatic acid gas necessarily contains water. If either of these positions is established, Mr. Davy's hypothesis falls to the ground. There is, however, great difficulty in contriving an unexceptionable experiment, since most of the common appearances in experiments with these bodies may be explained on either hypothesis.

The object of Mr. Murray, in the present paper, is to combine muriatic acid with a substance confessedly free from oxygen, and which does not decompose the acid (both of them being previously freed from adhering moisture), and to ascertain whether water appears after combination. Ammonia was the substance selected for the experiment, the particulars of which are briefly the following. Thirty cubic inches of ammoniacal gas dried over quicklime, were

combined over mercury with thirty-two cubic inches of dried muriatic gas. The white feathery muriate of ammonia thus produced was immediately put into a small retort, and, on applying a gentle heat, less than was sufficient to volatilize the muriate, a quantity of aqueous vapour was expelled, which condensed in drops in the neck of the retort. The salt lost by this process, from 1.3 to 1.5 grains, which was about one-ninth part of its weight. This loss, which is owing to the moisture expelled, was likewise not the whole quantity of water contained in the salt, for, on distilling the muriate of ammonia with dry charcoal, the products were more moisture, together with the production of carbonic acid and carburetted hydrogen gas produced by the action of part of the aqueous vapour on the hot charcoal. The quantity of water produced in the second experiment, that is, the distillation of the muriated ammonia with charcoal, Mr. Murray estimates to be not less than that produced in the direct combination of the muriatic and ammoniacal gasses: hence he concludes, as a general inference, that when the muriatic and ammoniacal gasses (both freed from all adhering or hygrometrical moisture) are combined in the proportions requisite to saturation, the resulting muriate of ammonia will contain from one-fourth to one-fifth of its weight of mere water, which water, he infers, originally existed in the muriatic gas, and was essential to its gasseous constitution.

On the supposed Presence of Water in Muriatic Acid Gas.—Phil. Journ. No. 143.

THE anonymous author of this short communication, states a practical objection to the supposed accuracy of Mr. Murray's experiment related in the preceding article. Sir H. Davy made the following experiment at the Royal Institution, which this correspondent has repeated. Pure and dry ammoniacal and muriatic gasses were introduced into an exhausted retort which combined into muriate of ammonia. Heat was then applied and continued till the salt was sublimed into the cooler part of the retort, but not a particle of condensed aqueous vapour appeared. On repeating the experiment, with the difference of exposing the salt for a few minutes to the atmosphere, water was *now* obtained in very sensible quantity. Hence the author concludes, that in Mr. Murray's experiment the water was obtained from the atmosphere, and not from either of the constituents of the muriate of ammonia.

On the Nature of Oxymuriatic and Muriatic Gas, in reply to Mr. Murray. By JOHN DAVY, *Esq.—Phil. Jour. No.* 144.

MR. JOHN DAVY begins with some observations on his objections to Mr. Murray's inference from his experiment of producing carbonic acid from a mixture of carbonic oxyde, hydrogen, and oxymuriatic gas. But the chief subject of this communication is an experimental examination of Mr. Murray's alleged *experimentum crucis* of obtaining water from a mixture of the muriatic and ammoniacal gasses, as already described. Mr. J. Davy's counter-experiment is almost precisely the same as that described in the article immediately preceding. Dry muriatic and ammoniacal gasses were added together in small quantities at a time, in a small retort over well-dried mercury, till about 30 cubic inches of each gas were expended. The resulting muriate of ammonia was then heated, but no water was made obvious. The experiment was then repeated, but with the difference of exposing the salt a short time to the air (as in Mr. Murray's experiment), and *then* a notable quantity of water appeared.

Mr. Davy also brings as a collateral objection to Mr. Murray's experiment, that if water is liberated from muriatic acid gas on mixture with ammonia, this water after condensation could not fail of absorbing a portion of muriatic gas, if more were added than was necessary to the saturation of the alkali. But on trial, no such absorption took place after the acid gas had been added to excess; and hence Mr. D. infers no water could be present.

Experiment to prove whether Water be produced in the Combination of Muriatic Acid and Ammoniacal Gas. By JOHN BOSTOCK, *M. D. and* THOMAS STEWART TRAIL, *M. D. —Phil. Journal, No.* 146.

MR. MURRAY'S experiment was repeated by these gentlemen with great care. The muriatic acid gas, prepared from dry muriate of ammonia and concentrated sulphuric acid, was dried by muriate of lime, and the ammoniacal gas was dried by remaining 48 hours in contact with a lump of dry quicklime. The muriate of ammonia produced, on mixing the gasses, was then heated (without previous exposure to air), and a very sensible quantity of moisture condensed in the cooler part of the vessel. Part of the muriate of ammonia was then taken out and put into a very sensible balance, one minute having elapsed between the moment of removing the salt and equipoising the balance. The salt then was left for 15 minutes in the scale exposed to the air, but no increase of weight occurred.

Remarks on the Experiment of Dr. Bostock and Dr. Trail, in a Letter from a Correspondent.—Phil. Journal, No. 147.

The Correspondent here objects to the mode of drying the ammoniacal gas employed in the last-mentioned experiment, which was performed by a lump of quicklime instead of dry muriate of lime. He observes, that the best method of drying any gas is to pass it repeatedly through muriate of lime in coarse powder previously heated.

Observations.—We have given together all the experiments hitherto published on this important question, which shew the difficulty of making an unexceptionable experiment, and of guarding against every possible source of error. It is clear, however, that supposing them all to be faithfully related, that of the Davy's is the most decisive of the point in controversy. If muriated ammonia can be produced without the appearance of water, then it is obvious, that water is not a necessary constituent of muriatic acid gas. Some fuller examination, however, of the muriated ammonia produced, seems requisite, than mere application of heat to the salt. The experiment of Drs. Bostock and Trail shews at least, that muriate of ammonia is not quite so greedy of moisture during a short exposure to the air, as might be inferred from the other experiments.

A Reply to some Observations published in the Medico-Chirurgical Transactions "on the Nature of the Alkaline Matter contained in various Dropsical Fluids." By George Pearson, *M. D. F. R. S.—Phil. Journal, No.* 142.

An Answer to the above Paper. By Alexander Marcet, *M. D. F. R. S.—Phil. Journ. No.* 143.

A Rejoinder to Dr. Marcet's Paper. By Dr. Pearson.—*Phil. Journ. No.* 146.

These papers contain a controversy between the two learned physicians and chemists, on the nature of the free alkali found in the residue, after the evaporation of various animal fluids, particularly the serum of the blood, and also in various limpid fluids effused by disease into several cavities of the body. The saline residue of these fluids has generally an excess of alkali, and affords crystals obviously differing in form and appearance, of which some are cubic and the others generally spiculæ. The question to be determined is, what is the uncombined alkali? is it potash or soda? There are two ways of determining this, either by selecting the

different sorts of crystals and examining them separately, or by adding to the whole an acid different from any already present and of weaker affinity towards both the alkalies, and then ascertaining the nature of the new salt thus produced by the free alkali and the acid added. The acetic acid fulfils this condition better than most others, and there is sufficient difference between the acetate of potash and of soda to be distinguished where the quantities are in considerable proportion. The acetates too are soluble in alcohol, and hence may be separated from sulphates and muriates *to a considerable degree* by this re-agent. It unfortunately happens, however, that this is but an imperfect mode of operating where the proportions of one salt to the other are very small; and also some of the salts, said in a general way to be insoluble in alcohol, are in fact partly soluble if much of the spirit be used, and that not very highly rectified. Again, it is found, that the action of simple affinities is also materially influenced by relative quantities, by crystallization, &c. Thus, though a mere inspection of the table of affinities would make it appear impossible for muriate of soda to coexist in the same solution with carbonate of potash; yet experience shews, that it is impossible to decompose common salt totally by potash, but only partially, and the solution may contain both the muriates and an excess of both the carbonates.

With regard to the subject of this controversy, we shall not go through the task of analysing every part; it is sufficient to say, that Dr. Pearson's objections to Dr. Marcet's experiments are founded chiefly on the excessive minuteness of the quantities, which render it seldom possible to pursue the examination of any individual product beyond the test of a single precipitation or other chemical appearance.

Dr. Marcet, in his reply, defends himself against this objection with considerable force, and enumerates many of the more important chemical discoveries that have been made with small apparatus and minute quantities.

We still however think that Dr. P.'s objection has some weight.

With regard to the general question of the nature of the free alkali in these animal fluids, it is obvious, that no unexceptionable mode of analysis has yet been devised, and perhaps can hardly be done, considering the minuteness of the proportion of alkali. Concentration by evaporating the watery solvent, may indeed enable the chemist to ascertain all the saline materials and all the proportions of them; but it does not necessarily follow, that he can thence infer the exact mode of combination in which they exist in the original fluid. The difficulty too is much increased when another re-agent is introduced (such as the acetic acid), whose affinities for all the substances present must alter and materially interfere with those previously in force.

Account of some new Experiments on Wood and Charcoal. *By* BENJAMIN COUNT OF RUMFORD, *F.R.S.—Phil. Journ. No.* 147.

THE ingenious author of this communication relates, that being desirous of trying how far the mere drying of wood short of carbonization could be carried, he first put several portions of shavings of different sorts of wood into a stove of moderate heat, and dried them there during twenty-four hours. At the end of this time the colour of the shavings was not altered, and the loss of weight about a tenth. On exposing them to the same heat for a second time, the colour had now begun to change to brown, and there was a further loss of weight. A third heating completely blackened them, and produced a yellow stain on a glass jar with which they were covered. The heating was repeated four other successive times, until the covering jar had become quite clear, and the shavings of lime wood (on which the experiments were continued) were reduced to a twentieth of their original weight.

Common charcoal was then submitted to the same trials. The charcoal was first well ignited and reduced to a very fine powder. On exposing a thin layer of this powder to the same stove heat, it entirely disappeared. On the other hand, some lamp-black heated at the same time came out of the stove as black as it was put in.

Lastly, to ascertain whether the disappearance of the wood and charcoal under this low heat was owing to combustion and the generation of carbonic acid, three parcels of dried shavings were stoved as before, one of which was exposed on an open saucer, the second was covered with a single glass jar, and the third with two jars one inclosing the other. After stoving, the shavings of the first portion had entirely disappeared, leaving only a few ashes; in the second, the shavings were reduced to $1\frac{1}{2}$ per cent. of their original weight, but retained their form; and in the third the wood was only charred. The loss of weight is not mentioned. Hence the author concludes, that the combustion, which was complete in the first portion was impeded in the second, and was prevented entirely in the third, where the double jar made the covering more complete, and detained the carbonic acid gas.

The general inference which the author makes is, that charcoal can unite to oxygen, and form with it carbonic acid gas, at a temperature much below that at which it burns visibly.

Memoirs on Nickel. *By* M. RICHARD TUPPUTI.—*Ann. de Chim. Vols.* 78 *and* 79.

IN No. 30, of our Retrospect, page 250, we gave an abstract of part of this memoir, in which the author describes his method of

obtaining pure nickel, or at least, combined only with a small portion of carbon.

This metal has two degrees of oxydation, the *protoxyd* is prepared by adding potash or soda to any of its solutions, and washing and igniting the precipitate. In this way 100 parts of the metal become 127 of protoxyd. The *peroxyd* is made either by passing a current of oxymuriatic gas through the oxyd when just precipitated, or by digesting the protoxyd before drying it, with oxymuriate of lime. This peroxyd is black, and gives out oxygen during solution in acids.

The *hydrate of nickel* is greenish-yellow when first formed by precipitation with an alkali. A hundred parts of dried hydrate give out in a red heat 24 of water, and the remaining 76 parts are protoxyd.

Nickel unites with sulphur, and this combination much resembles pyrites.

When zinc is added to a solution of sulphat of nickel, a very slight precipitation is formed; but the zinc dissolves quietly, and forms a triple sulphat of zinc and nickel. Nickel is not precipitated by copper.

On the other hand, nickel does not decompose the solutions of zinc, iron, and copper.

Dilute sulphuric acid dissolves nickel very well when heated. It gives a fine green crystallized salt with a sweetish astringent taste: 100 parts of this salt contain 29.37 sulphuric acid, and 25.63 oxyd of nickel, and 45 of water.

The nitre acid dissolves nickel with ease. The salt is blue-green, and soluble in alcohol.

The muriatic acid when heated dissolves this metal easily, forming an apple-green salt. The muriat dissolves in alcohol, and produces when burning a fine green flame.

Most of the other acids unite with nickel, which are described by the author.

Sulphat of potash and sulphat of ammonia unite with a definite proportion of oxyd of nickel, forming green crystallizable salts. Many other of the neutral salts crystallize in like manner with the solutions of nickel. They are prepared by adding the two solutions together, and evaporating to the crystallizing point. Thus, muriat of ammonia and muriat of nickel form the triple muriat of ammonia and nickel; nitrat of ammonia and nitrat of nickel form the triple nitrat, &c.

M. Tupputi makes the following general remarks on these salts:

They are all more or less of a green hue, except the solvent itself is coloured, as with the chromic acid. They have all rather an excess of acid, and have a sweetish taste mixed with a metallic astringency. When heated so as to lose their water of crystallization, the soluble salts become yellow, and the insoluble brown. This metal has a very remarkable tendency to form triple combinations with most neutral salts.

The fixed alkalis have no action on the oxyds of nickel, though they dissolve a little of the hydrat when newly precipitated.

The green hydrat of nickel as well the peroxyd, of which this hydrat is composed, dissolve in ammonia, forming a blue solution, long known to chemists as furnishing a very characteristic test of this metal. This colour is violet when but little of the oxyd is dissolved, but as the solution becomes more saturated, it passes through various shades to the deepest enamel blue. If to the soluble salts of nickel (the nitrat or muriate for example,) a small quantity of ammonia is added, a triple muriat or nitrat of nickel with ammonia is formed, and part of the oxyd separates as a green hydrat; but if a larger dose of the alkali is added, the whole makes a clear blue solution. This is gradually decomposed by exposure to the air; the excess of ammonia requisite to keep the oxyd in solution flying off, and a triple carbonat of ammonia and nickel is added to the other salts.

Many other facts relative to the action of ammonia are added.

Sulphuretted hydrogen has but little action on the solutions of nickel in any mineral acid. A small portion of black hydrosulphuret is separated, but by far the greater part remains in the solulution, the green hue of which is not changed. The acetate of nickel is more readily decomposed. Any excess of acid retains the hydrosulphuret in solution. On the other hand, the alkaline hydrosulphurets separate all the nickel with ease. By exposure to air they become sulphates of nickel, the oxyd being at the lowest state of oxydation.

The author adds the following tests of the purity of nickel, which we shall give, as being practically useful to the chemist.

The metal should dissolve entirely in muriatic acid, except the small and variable proportion of carbon with which it necessarily unites during its reduction, and which appears as black flocculi in the solution. The solution, when neutralized, should turn yellow when paper stained with it is heated.

Prussiat of potash should form a yellowish white precipitate, a little inclining to green, which, when an excess of ammonia is added, should first dissolve therein, and turn of a dirty rose colour, and afterwards should deposit crystalline laminæ of the same colour. This solution, when acidulated, should not be changed by sulphuretted hydrogen, nor by metallic iron, nor by ammonia in excess, which turns it blue. When the acid solution is diluted, tincture of gall-nut should separate white flocculi.

By these tests the absence of iron, copper, cobalt, bismuth, and arsenic, will be proved.

Observations.—This memoir, which is long and minute, is valuable on account of the variety of experiments which are related, which appear to be faithfully performed; and which add

materially to the chemical history of a substance that has been rather neglected by chemists. There is some want of perspicuity in the mode in which the memoir is drawn up, and some unnecessary repetition; but the great pains obviously bestowed on the subject, must entitle M. Tupputi to the thanks of the experimental chemist.

Description of a New Species of Ether produced by the Action of the Arsenic Acid on Alcohol. By M. BOULLAY.—*Ann. de Chim. Vol.* 78.

M. BOULLAY has succeeded in producing a true arsenic ether, which is proved to belong to this class of bodies by the following properties: it is highly volatile and odorant, of a hot sharp taste, does not redden litmus, nor give any other mark of acidity; swims on water, and burns on its surface with a white flame and a black smoke, and leaves no acid in the water. When rectified over muriate of lime its specific gravity is only .69.

M. Boullay prepares it by adding alcohol to a hot solution of arsenic acid, by the assistance of a stoppered double funnel of his own invention, the construction of which could not readily be understood by mere description.

A Method of depriving Vinegar and other Vegetable Liquids of their Colour by means of Animal Charcoal. By M. FIGUIER.—*Ann. de Chim. Vol.* 79.

THE author's simple process is the following: mix a litre (about 1 and $\frac{3}{4}$ of an ale pint) of coloured vinegar with forty-five grammes (eleven drams, thirty-five grs. troy) of bone charcoal, stir them frequently without applying heat, and in twenty-four hours, the vinegar will begin to clarify, and in two or three days it will become, after filtration, as limpid and colourless as water, without losing any of its smell, taste, or sourness. A less quantity of the charcoal will suffice by longer digestion. Red wine and many other liquors are deprived of colour in the same way.

The animal charcoal is prepared by filling a crucible with the most compact ox or sheep bones, and luting on a cover with a small hole drilled through. Heat is then applied, at first moderate as long as any inflammable vapour issues through the hole, and then pretty briskly for a short time. When the crucible is cold, the charcoal is reduced to fine powder, and kept for use.

Observations.—The decolouring power of wood charcoal has long been known, but is seldom employed for any practical purpose. The *common* lamp-black of this country is the animal coal in question. It differs from wood charcoal essentially, in consisting only of a small portion of carbonaceous matter, but a very large one of phosphate of lime, some of which dissolves in the vinegar. The author finds that ivory-black answers as well.

Analysis of Opopanax. By M. PELLETIER.—*Ann. de Chim. Vol.* 79.

THIS gum resin, which is a little employed in medicine, is in the form of roundish tears or lumps, of a dirty yellow, and generally obviously impure. Opopanax, when examined by the full method employed in vegetable analysis in the present day, yielded the following substances; viz. resin, gum, ligneous fibre, starch, extract, wax, malic acid, volatile oil, and a trace of caoutchouc. When burnt to ashes, the residue afforded carbonat of lime, silex, carbonat, sulphat, and muriate of potash.

Analysis of some of the Gum Resins. By M. PELLETIER.—*Ann. de Chim. Vol.* 80.

THE resins whose analysis is given in this paper, are *bdellium* and *myrrh*. The latter has been also examined by M. Braconnot, who asserts, that the gummy part becomes insoluble after desiccation; but the observations of M. Pelletier do not confirm this. The constituent parts of myrrh are a resin, a gum much resembling simple mucilage, and an acid in small quantity, which the author has not been able to separate from the other ingredients.

On the Potash extracted from the Fruit of the Horse Chesnut Tree. By M. D'ARCET.—*Ann. de Chim. Vol.* 79.

BY the author's observations, the ashes of both the fruit and its husk yield a large proportion of potash, which is most abundant from the fruit. The quantity of alkali was estimated by saturating sulphuric acid of known specific gravity. On the average of two or three experiments, the author found that one hundred thousand parts by weight of chesnuts with their husks, previously well dried in the air, yield, by combustion, 3485. parts of ashes, from which may be extracted 1741. parts of potash of equal quality with the best American pearlash.

Analytical Researches on the Nature of Champignons. *By* M. HENRY BRACONNOT.—*Ann. de Chim. Vols.* 79 *and* 80.

THE numerous class of plants known by the general term of *champignons*, includes a vast variety of individuals, some of which, like the common mushroom, are esculent, others noxious, but all of them have a common resemblance of form, and in general have a soft fleshy texture.

Enough has been done with regard to their chemical analysis, to shew that they differ in many particulars from all other living vegetables; but the author of this memoir has gone through a long and interesting chemical investigation of these bodies, of which the following abstract contains some of the most important facts:

M. Braconnot begins by describing a peculiar modification of vegetable matter not found hitherto in any other substances, but which abounds in most of the champignons. He gives it the name of *fungine*, and it has the following properties. It it separated from the other parts of the fungus by boiling water a little alkalised; and it is then a white, pulpy, insipid, scarcely elastic, substance, easily chewed, and apparently forms the chief part of the nutritive principle of the esculent fungi. Indeed many of those that are reckoned poisonous, are freely and abundantly eaten in many parts of Europe, and are rendered innocent by boiling, which extracts the noxious principle.

When *fungine* is burnt, it does not coil up like animal matter, but gives the smell of toasted bread. It burns with a bright flame, and leaves a very white ash. When fungine is distilled by itself with a graduated heat, it yields a thick empyreumatic oil and a yellowish liquor slightly alkaline but not carbonated; the alkali of which is shown to be ammonia by subsequent distillation with potash. The yellowish liquor also contains acetous acid, though not enough to saturate the ammonia. The coal of fungine yields an ash composed almost entirely of phosphate of lime mixed with a little carbonate of lime and phosphate of alumine and iron.

The alkalies fixed as well as volatile have but a weak action on fungine, but a strong lye of potash dissolves a portion in a boiling heat into a soapy mass decomposable by acids.

Sulphuric acid does not dissolve fungine.

Muriatic acid boiled upon fungine, converts it into a gelatinous mass soluble in water.

Oxymuriatic acid changes it to a kind of adipocire.

Fungine distilled with nitric acid swells at first prodigiously, dissolves, and yields a little prussic acid. The nitric liquor, thickened by evaporation, gives oxalate of lime, and two substances, one resembling suet and the other wax.

When soft fungine is kept in an infusion of gall nut, it becomes tanned, exhausts the infusion of its tannin, and assumes a fawn colour.

Fungine left to spontaneous decomposition putrifies like the gluten of wheat.

The individual fungi analysed, were the following:

1. *Agaricus Volvaceus.*—This fungus was rubbed with water and the liquor filtered. Distilled vinegar separated some albumen, which principle also coagulated on heating. Litmus was reddened by the liquor. Lime water and muriat of lime precipitated white flocculi. Nitrat of lead also produced a phosphat of this metal. On evaporating the juice of this fungus to dryness, and treating the residue with alcohol, this dissolved a substance much resembling sugar, but more easily crystallizable. The prevailing acids of this fungus were the phosphoric and acetic. It also was found to contain fungine, albumen, gelatine, and adipocire, besides some other saline matters.

2. *Agaricus Acris.*—This champignon is common in woods, and is white, with a short and thick stalk and a broad hat-shaped summit. Though reckoned poisonous, it is often eaten with impunity, and the author found that the acrid taste totally disappeared by slight drying. The composition of this fungus much resembles the last-mentioned. The *marc* (or cake remaining after all the juice has been separated by water and pressure) contains a good deal of adipocire or spermaceti-like matter, which may be extracted by boiling alcohol.

3. *Hydnum repandum Linn.*—This is an acrid fungus common in woods; which, however, is eaten by the country people in France, boiled with fresh butter, salt, and pepper.

Its chemical analysis shews most of the ingredients of the first-mentioned fungus, but it contains a remarkable quantity of sugar.

4. *Hydnum Hybridum* resembles the other species.

5. *Agaricus Cantharellus Linn* resembles the other species.

6. *Boletus Viscidus.*—This fungus tastes sour; when rubbed with warm water, it dissolves almost entirely into a thick ropy liquid, which retains its clamminess when largely diluted with water. Neither tannin, nor corrosive sublimate, nor lime water, nor alkalies, produces any obvious change. The ropy liquid just saturated with alkali and evaporated, was found to be (with the exception of acetate of potash) almost identical with animal mucus.

7. *Boletus pseudo-igniarius.*—The expressed juice of this boletus has a yellow colour and an agreeable mushroom flavour mixed with a slight acidity. Some albumen was separated by heat; and the liquor evaporated nearly to dryness, and treated with alcohol partly dissolved in it, giving not a concrete sugar, but an uncrystallizable saccharine mucus. On the other hand, the portion

of the extract of this boletus which was insoluble in alcohol, was re-dissolved in water; nitrat of lead was added, which gave an abundant precipitate, from which the lead was separated by sulphuretted hydrogen, leaving in the liquor the acid contents of the fungus. Part of this liquor formed a crystallized acid on evaporation, and the residue was an acid deliquescent mass, which was phosphoric acid.

The *crystallized acid* was examined with care, being different from any one hitherto known. To purify it, it was dissolved in alcohol, and by evaporating the spirit the pure acid was left in the form of white permanent prismatic grains, feeling hard in the mouth, and giving a taste like cream of tartar. This acid forms a salt with lead, which is somewhat soluble: it precipitates iron from its solutions when fully oxydated, but not in an inferior state of oxydation.

Lime-water and barytes produce but little change. This acid, when heated by itself in a retort, sublimes in crystalline needles, which are the acid unaltered, except being rendered purer by parting with a portion of acrid oil in the process.

This acid forms with ammonia a salt of sparing solubility, which readily and totally decomposes the solutions of highly-oxydized iron, but does not alter the sulphats of lime, alumine, and manganese; and hence it may be employed like the succinic or benzoic acids in the hitherto difficult process of separating iron alone from various compound solutions. On the whole, the concrete acid of this boletus has the nearest resemblance to the benzoic in its properties.

8. *Mucor Septicus.*—This fungus generally appears on the bark of hot-beds in the form of a yellowish cake in three distinct laminæ; the upper one of which is usually covered with an efflorescence of carbonat of lime; and this earth is obtained abundantly from the whole fungus, so that it effervesces violently in acids. The author obtained also from it the substance he has described under the term fungine and albumen. Another singular product of this fungus is a yellow powder, which abounds in the fungus when gathered and slowly dried. This powder is not readily soluble in water alone or in alcohol, but a weak alkaline lye extracts it in abundance, and acids separate it of a blood-red colour. This matter seems to have a strong affinity for wool and silk, and gives a good dye.

9. *Phallus Impudicus.*—This very fetid and short-lived fungus gives most of the usual constituents common to all the other fungi.

Observations.—The whole of this paper is interesting, as it relates to a class of bodies which have been thought to form a connecting link between animal and vegetable substances, and the author has shewn much practical skill and industry in his undertaking. Many more

of the champignons are used as esculent vegetables on the continent of Europe than in this country. There is every reason to believe, from their composition, that they are highly nutritious, and from their rapid and spontaneous growth, they perhaps deserve more attention than has hitherto been paid to them.

On the Non-existence of Sugar in the Blood of Persons labouring under Diabetes Mellitus. *By* W. HYDE WOLLASTON, *M. D. Sec. R. S.—Phil. Trans. for* 1811; *or Ph. Journ. No.* 143.

Dr. Marcet's Reply to Dr. Wollaston on the same Subject.—Ph. Journ. No. 143.

DR. ROLLO, in his Enquiry on Diabetes, endeavoured, with the assistance of the late Mr. Cruikshank, to detect by chemical means in the blood of diabetic patients, the cause of that copious supply of saccharine matter which is found in the urine in persons labouring under that singular disease. The experiments were unsatisfactory, and the object of Dr. Wollaston in this highly-valuable paper is, to pursue the subject by other chemical methods to determine with more accuracy whether any sugar exists in the blood under this disease.

Dr. W.'s method of operating was first to produce an entire coagulation of the albuminous part of healthy serum, and then to compare the appearances occurring on the crystallization of the saline matter of the fluid part of the serum with those that take place in other portions of the same fluid after different quantities of sugar had been intentionally added. Having thus got a standard of comparison, Dr. W. proceeds to compare the sugared serum with the serum of diabetic patients.

The first process, that of completely coagulating the albumen of healthy serum, was effected by the assistance of muriatic acid. Half a dram of this acid, diluted with one dram and a half of water, was added to six drams of serum, and the phial containing them was immersed in boiling water for four minutes, at the end of which the coagulation was complete. The watery liquid which exudes from the coagulum (the *serosity* as it is termed by physiologists), when evaporated gradually, yielded its saline ingredients with great ease and in very distinguishable forms.

On adding different quantities of sugar to separate portions of the serum before coagulation, Dr. W. found that the crystallization of the salts was either impeded or wholly prevented, according to the proportion employed. Even so little as two grains and a half of sugar to an ounce of serum, shews itself by some blackness in the crystallization, and with five grains no permanent crystals can be

obtained. Sugar extracted from diabetic urine produced the same effects.

The blood of diabetic patients was then examined in many experiments, but in none of them could any sugar be detected in the serum.

The latter part of this interesting inquiry contains comparative experiments on the urine and blood, and other secretions, after the person had taken so much prussiat of potash as to give to the urine a very sensible impregnation of the prussiat so as to strike a perceptible blue with salts of iron. Under these circumstances, though the prussiat was taken directly into the stomach, and the urine was sensibly impregnated with it, no trace of it was found in the serum of the blood, in the saliva, or nasal mucus.

Dr. Marcet's letter contains further experiments on this very curious subject. The urine of a person was sensibly affected by prussiat of potash taken in the dose of five grains every hour for fourteen hours, and gave an immediate blue colour to sulphat of iron. A blister was then applied, and the fluid of the blistered part examined with sulphat of iron, but no change occurred.

It was found, however, that the prussiat was not conveyed to the urine in all the persons who tried it with equal facility.

Observations.—The main point in these curious experiments is, to shew the probability of some more direct passage from the stomach to the kidneys than by the usual round of circulation through the blood-vessels. This had long been suspected, but no experimental inquiry had been instituted till the present. The argument is, if any soluble substance taken into the stomach appears in the urine alone and not in the blood, it is impossible that this substance can be conveyed into the bladder through the circulating system; and therefore some other channel hitherto unknown must exist.

It has, however, been properly objected by Dr. R. Pearson and Dr. Henry, that this inference is not quite satisfactory till the arterial blood has been examined as well as the venous.

A Chemical Account of an Aluminous Chalybeate Spring in the Isle of Wight. By ALEXANDER MARCET, *M. D. F. R. S. —Transactions of Geological Society, Vol. I., or Phil. Journ. No.* 146 *and* 147.

THIS chalybeate spring is situated on the south-west coast of the Isle of Wight, about two miles to the westward of Niton, and was discovered by Mr. Waterworth, surgeon at Newport. Vari-

ous trials have been made of its medicinal value, all of which concur in giving it the character of a very powerful chalybeate.

The present paper contains a very minute analysis of the water by Dr. Marcet, whose eminent skill and perseverance in these chemical operations is so generally acknowledged.

It is impossible to give our readers any thing like an abstract of this paper, as it consists of the account of a prodigious variety of experiments in analytical chemistry, apparently performed with great accuracy, which answer the purpose not merely of coming at a knowledge of the contents of this individual water, but also of serving as a general practical view of all the methods commonly employed in the analysis of the saline, earthy, and metallic contents of most natural waters. The substances which it is the object of these experiments to separate from each other are silex, alumine, lime, magnesia, iron, and soda, all united with the sulphuric or muriatic acids. The processes which have the most novelty are, the separation of iron and alumine from its solutions by means of the succinic acid, and the precipitation of magnesia by the phosphoric acid and ammonia in the form of the insoluble ammoniaco-magnesian phosphat.

With regard to the individual water under analysis, it is found to contain an unusual quantity of sulphat of iron, no less than 41.4 grains in the pint, together with a good deal of mere sulphat of alumine, of which the proportion is such as would produce 31.6 grains of crystallized alum on the addition of the requisite proportion of potash. It contains also 16 grains of sulphat of soda.

For medicinal use, it has been found expedient to drink this mineral water in a diluted state.

Extract from a Memoir on the Analysis of Chyle. By M. Emmert, *of Berne.—Ann. de Chim. Vol.* 80.

The author's experiments were made on the chyle of a horse, who was glandered, and was killed on that account; the chyle was taken from four different parts of the thoracic duct, the author's object being to examine the gradual changes which must take place in this fluid in the course of its conversion into blood. All the specimens of chyle had the consistence of serum, and all coagulated spontaneously; but a very great difference in this property was observed. The fluid from the part of the thoracic duct nearest the heart coagulated rapidly into a reddish gelatinous mass, which in an hour was as hard as boiled white of egg, and on the surface of which a greenish fluid exuded. On the other hand, the chyle nearest the mesenteric vessels gave but a small quantity of tender coagulum. No sugar was found in the fully elaborated chyle. On the whole, the author seems to think that analysis shews too great a difference

in the contents of the first and the last parts of the chyliferous vessels, to be accounted for by ordinary chemical changes; but that the lymphatic vessels themselves must assist in the conversion of their contents into blood.

Description of the late Montgolfier's Process for making White Lead, communicated by CLEMENT *and* DESORMES.—*Ann. de Chim. Vol.* 80.

THE process contrived and executed by this celebrated philosopher was the following, in a few words:

The lead was first reduced to sheets, in the old method of casting on an inclined plane. This is preferable to rolling, as the texture of the metal is more open, and the surface somewhat uneven. A common reverberatory furnace burning charcoal was employed, the chimney of which, after proceeding a few feet perpendicularly, was bent to a right angle, and was made to enter horizontally into the middle of a large cask lying down on its side. The flue of the chimney was continued from the other end of the cask, and communicated with a large square box in which the sheets of lead were arranged, alternately fixed to the top and the bottom of the box, to detain the current of air for a longer time before it finally escaped through a pipe at the furthest extremity.

In this arrangement, the carbonic acid from the burning charcoal of the furnace would first be conveyed (along with some undecomposed common air, and a good deal of azote) into the tub, the bottom of which was covered with vinegar, and this acid being vaporised by the hot air, would accompany the carbonic acid and other gasses into the lead-box, and thus furnish all the materials requisite to corrode the lead and convert it into cerusse or white lead. The plates were scraped from time to time, and the white lead separated and purified by levigation with water.

Description of a New Crystallized Substance which gives to the Cocculus Indicus its deleterious Qualities. By M. P. BOULLAY.—*Ann. de Chim. Vol.* 80.

THIS peculiar substance is thus obtained: make a strong decoction of the cocculus indicus berries, add to it acetate of lead as long as any precipitate falls down; filter the liquor, and evaporate it slowly to an extract. Dissolve this extract in alcohol, and evaporate the solution again. Repeat the solution in alcohol and evaporation till the extract is totally soluble in the spirit. The extract then contains a little colouring matter, which is dissolved

in a little water by agitation, and at the same time a number of small crystals fall down, which, to be pure, must be again washed with water, dissolved in alcohol, and the solution evaporated.

These crystals are white, and have the form of four-sided prisms. They have a most intense bitterness. Boiling water only dissolves one twenty-fifth of its weight of this salt, half of which separates on cooling. Highly rectified alcohol dissolves a third of its weight, and the solution may be diluted without separation. Ether dissolves but little, and oils none at all, and the mineral acids hardly any, unless concentrated, when they destroy it. Acetous acid dissolves it with ease, as do the caustic alkalies. This crystalline matter gives no ammonia by distillation. It bears some resemblance to the *bitter principle* of Welter, but differs from this latter in some essential points. The author considers it as highly poisonous as well as bitter, but gives no experiments in proof of its deleterious qualities. He proposes to give it the name of *Picrotoxine*, as expressive both of its bitterness and its poisonous quality.

Notice on Linseed Mucilage, and on the Mucous Acid which it yields when treated with Nitric Acid. By VAUQUELIN.

Analysis of Linseed Mucilage. By the same.—Ann. de Chim. Vol. 80.

It having been asserted, that some of the vegetable mucilages differ from the proper gum mucilages, in yielding no mucous acid when treated with nitric acid, as the gums do, this eminent chemist made experiments to ascertain this point. Some linseed mucilage, thickened by evaporation, was treated with nitric acid, and yielded a good deal of mucous acid both at first and by the successive evaporation of the liquors. Some oxalic acid was also obtained.

It has been said, that starch slightly roasted, is changed into gum mucilage. This, however, M. Vauquelin finds not to be chemically correct, since roasted starch gives no mucous acid with the nitric, but only oxalic acid.

Analysis of Linseed.—Four pounds of water, divided into three portions, were boiled successively on a pound of linseed, by which all the mucilage was extracted. The solutions were mixed, strained, and evaporated to dryness in a copper basin, yielding a brown mass weighing seventy-five grammes.

This extract was put into a dry retort, with a proper apparatus for yielding the products, and heat was carefully applied to complete redness. The coal remaining in the retort resembled that from gum arabic. The distilled liquid reddened litmus, but also gave a vapour which formed a dense white smoke round a glass rod wetted with nitric acid, whence the author infers the presence

of the vapour of acetated ammonia. Into the gasseous product of the distillation was introduced a piece of paper wetted with green sulphat of iron, but this did not turn blue on subsequent exposure to muriatic and oxymuriatic vapour, and hence no *vaporized* prussic acid was present. The distilled liquor, however, gave marks of this acid, and the coal in the retort calcined with potash, saturated with weak sulphuric acid, and then combined with sulphat of iron, gave a notable proportion of *prussian blue*. The ashes of the coal of linseed, shewed also the presence of muriat, sulphat, and phosphat of potash, and carbonat and phosphat of lime.

The azote present in linseed, though it could not be obtained separately, was proved by the prussic acid and the ammonia, and also by the extracted mucilage giving a yellow colour to nitric acid.

The acid that exists in linseed mucilage, appears to be the acetic, and this united to potash, is probably the substance that gives this mucilage its diuretic quality.

The author conjectures, that all the viscous vegetable mucilages contain a certain quantity of azote, to which he partly attributes the viscid property.

A hundred parts of linseed yielded fifteen parts of dry mucilage. A hundred parts of the dry mucilage left after distillation, twenty-nine parts of coal, including the saline matter; and produced a quantity of ammonia which required eight parts of sulphuric acid of 10° of strength (1.076 specific gravity) for saturation.

A hundred parts of the coal of linseed mucilage, yielded all the prussic acid entering into $2\frac{2}{3}$ parts of prussian blue.

Analysis of Saffron. By Messrs. BOUILLON LAGRANGE, *and* VOGEL.—*Ann. de Chim. Vol.* 80.

THE leading points of this analysis are the following:

Cold water becomes instantly yellow by the addition of saffron, and of a deep red on standing twenty-four hours. Sulphuric acid blackens this infusion when concentrated, and separates a little from it. Oxymuriatic acid deprives it completely of colour. Crystallized acetate of lead does not alter this infusion, but the *sub-acetat* of lead, or Goulard's extract, gives a copious yellow precipitate. The *watery extract* of saffron is digested with boiling alcohol, all the colouring matter is dissolved, forming a *deep yellow tincture*, and a colourless tenacious mucilage is left. When saffron is distilled with water there comes over first a milky, bitter, aromatic water slightly acid. Two oils appear at the same time, one swimming in the distilled liquor, the other sinking at the bottom. This latter has the same sensible properties of smell and taste as the dis-

tilled water. This oil seems remarkably readily soluble in water. Saffron retains its essential oil with great obstinacy, so that repeated distillation cannot separate the whole. This circumstance, together with its great solubility in water, prevented the authors of this memoir from determining its proportion to the entered saffron. The essential oil of saffron stiffens on keeping, and assumes a crystalline form, and swims on water; one of the oils obtained on distillation as above-mentioned was doubtless of the same nature.

To obtain the *colouring matter* of saffron separately, some saffron was repeatedly macerated in alcohol, and the tinctures thus obtained were evaporated to dryness. It was also obtained, and rather in a purer state, by first evaporating to the consistence of honey, the cold watery infusion of saffron, and then extracting the colouring matter from the residue by means of alcohol, and evaporating this latter tincture. By this means a little waxy matter is excluded, which mingles with the spirituous extract when the entire saffron is treated with the alcohol.

The spirituous solutions of this colouring extract is not made turbid by water, and hence it is not resin. The smell is sweet like honey, the taste bitter, with the peculiar flavour of saffron. The colouring extract dissolves in water as well as in spirit; the solution totally loses its colour when exposed to the sun, even in a closely corked phial. A few drops of sulphuric acid added to a dilute solution of the colouring matter gives it a lilac blue colour, which affords a useful test to determine the presence of saffron in any compound tincture of pharmacy, where it is often prescribed and often omitted. Nitre acid gives a fugacious green; but oxymuriatic acid destroys the colour entirely. Ether hardly dissolves any of it. The oils, fixed as well as essential, do not dissolve any portion. This matter possesses a very intense degree of colouring power compared to its quantity, a very small portion communicating a deep yellow to a large bulk of any liquid in which it is soluble. This circumstance has induced the authors of this memoir to give it the name of *Polychroïte*, and from these experiments it appears to compose about 05. per cent. of the weight of the entire saffron.

Memoir on different Combinations of Gold. By M. Oberkampf.—*Ann. de Chim. Vol.* 80.

The author begins by observing, that notwithstanding the labors of Bergmann, Lewis, and more lately of Proust and Vauquelin, on this metal, much remains to be done on the subject, and many important enquiries relative to its combination with oxygene, with sulphur, &c. are still unanswered. M. Oberkampf has therefore undertaken the experiments, of which we shall give a

short abstract, and which he observes, may have a particular interest at present, when the medicinal use of gold appears to be again revived (in Paris).

To dissolve gold, M. O. prefers the oxymuriatic to the nitro-muriatic acid, as a less excess of acid exists in the solution. When a part of the excess of acid is either driven off by heat, or neutralized by an alkali, the solution is brownish-red.

Hydrogene gas passed through this solution, gradually and with difficulty revives a portion of the metal.

Sulphuretted hydrogene gas, on the other hand, forms an immediate black precipitate, which is quite homogeneous to the eye, and appears to contain no reduced particles mixed with it; which is also confirmed by its retaining its uniformity when washed with water. 100. parts of this compound contain 80.39 of gold, the rest is reckoned by the author as sulphur, perhaps, with some water.

The alkaline hydrosulphurets produce black precipitate, similar to the last, and this precipitate is soluble in an excess of hydrosulphuret of potash, particularly when heated. The acids added to the solution again precipitate the sulphuret of gold, and disengage sulphuretted hydrogene. The sulphuret when treated with a solution of potash turns yellow, a portion is dissolved and the residue is a yellow powder which is insoluble in simple muriatic acid, and appears to be reguline gold.

Gold even when much divided does not dissolve in the alkaline hydro-sulphurets, except by adding more sulphur and applying heat.

Phosphuretted hydrogen gas, passed through the nitro-muriate of gold, separates at first a yellow-brown precipitate of metallic gold, and the liquor contains phosphoric acid. But if instead of stopping the current of phosphuretted hydrogen, it is continued without interruption, the yellow precipitate does not form, but instead of it the liquor becomes black and a black powder separates. If this latter substance is digested with nitro-muriatic acid, the phosphoric acid is produced; so that the precipitate must contain the basis of this acid, and appears to be a phosphuret of gold.

The precipitation of gold from its acid solutions by means of the alkalies, gives an unusual variety of appearances, according to the circumstances of the experiment. When only a small excess of potash is used without heat, the precipitate is orange-yellow, but black when there is much of the alkali. The clear solution always gives a further quantity of precipitate when heated.

On washing these precipitates, adding more potash, and again washing and testing the washings with nitrate of silver, the author finds that the yellow precipitate retains a portion of the dissolving acid, but the black retains none. Hence the yellow precipitates are properly salts of gold with excess of oxyde, which accounts for their styptic taste.

The alkaline earths act in a great degree like the alkalies on the solution of gold.

On the subject of the oxydation of gold, the author took some of the brown-black oxyde (which was shewn to contain no metallic gold by dissolving entirely in muriatic acid), and distilled it per se till the metal was reduced, which took place very rapidly, and then weighed the oxygen gas produced. In one experiment it indicated an increase of 9.82 of oxygen on 100. of gold; in a second, 10.21 of oxygen; and in a third 10.6. The mean of these is 10.01. These results agree with those of Bergmann, but differ from those of other chemists.

Gold has a strong tendency to form triple salts with its dissolving acid and any alkaline or earthy basis; and hence it is that so little of the metal is precipitated by alkalies or earths when the solution has much excess of acid.

The compound precipitates of the oxydes of gold and tin, formed by adding tin or its muriate to muriate of gold, varies extremely in its composition, according to the circumstances of the solution, so that hardly any fixed proportions can be laid down.

Experiments to determine the Quantity of Sulphur absorbed by some of the Metals when exposed to a dry heat. By M. VAUQUELIN.—*Ann. de Chimie, Vol.* 80.

It has been often an object with chemists, as the author observes, to determine the exact quantity of sulphur retained by metals when the mixture is in fusion; but owing to differences in the mode of making the experiments, there has been too great a discrepancy in the results to enable them to form the basis of any accurate calculations.

The following experiments were all made with the same precautions, as the author assures us, a heat necessary to fuse the mixtures was employed, and was continued long enough to drive off all the great excess of sulphur that was added to the metal in the first instance. The metals were also in as great a state of division as possible; and the access of air was excluded during the experiments. The following table will give the general results, in the composition of the dry sulphurets, the metals being supposed to be saturated with the sulphur employed.

Sulphuret of Copper.		*Sulphuret of Silver.*		*Sulphuret of Bismuth.*	
Copper	78.69	Silver	87.27	Bismuth	68.25
Sulphur	21.31	Sulphur	12 73	Sulphur	31.75
	100.00		100.00		100.00

Sulphuret of Tin.		*Sulphuret of Iron.*		*Sulphuret of Manganese.*	
Tin	85.9	Iron	78.	Manganese	74.5
Sulphur	14.1	Sulphur	22.	Sulphur	25.5
	100.0		100.		100.0

Sulphuret of Lead.		*Sulphuret of Antimony.*		*Sulphuret of Arsenic.*	
Lead	86.23	Antimony	75.	Arsenic	57.
Sulphur	13.77	Sulphur	25.	Sulphur	43.
	100.00		100.		100.

M. Vauquelin adds some observations on the mode of making the experiment where any peculiar circumstances occurred.

The sulphuret of manganese was made by heating strongly equal parts of dry carbonate of manganese and flowers of sulphur, which produced a sulphuret exactly resembling the native sulphuret of manganese, and dissolved in weak nitric acid with a copious evolution of sulphuretted hydrogen. On the other hand, another portion of the same dry carbonate of manganese was strongly calcined per se, and the loss noted in order to serve as a basis to calculate the loss of carbonic acid, which the carbonate of manganese must have lost during the fusion with sulphur. This experiment, however, is confessedly imperfect, since it does not determine whether the manganese in the sulphur retains the same proportion of oxygen as in the calcined carbonate.

Sulphuret of copper was roasted for some time in an open vessel, in a red heat to ascertain the changes that would be produced. The sulphuret melted, no sulphur exhaled, and the matter became greenish. On examination it was found to contain chiefly a sulphate of copper with excess of oxyde and a portion of metallic copper, which were separated from each other by weak sulphuric acid, which dissolved the former but not the latter ingredient.

With regard to the sulphuret of iron, M. Vauquelin explains the difference between his experiments and those of Proust on the same subject, from the higher heat used in the present instance.

Some experiments follow on the decomposition of the sulphurets of copper and silver by other metals.

Sulphuret of copper was heated strongly with its own weight of black oxyde of manganese, and reguline copper was produced.

Iron filings equally decomposed the sulphuret of copper.

Sulphuret of silver was decomposed by oxyde of manganese, by iron, and by copper.

Communications from Mr. ALLAN *and Mr.* STANCLIFF, *on Allan's Dividing Instrument.—Phil. Mag. No.* 166.

MR. ALLAN'S communication is a letter introducing one from Mr. Stancliff, in which Mr. Allan takes the opportunity to express his opinion of our work, by calling it a "certain obscure publication," and to flatter Mr. Stancliff on his celebrity "for extraordinary nicety in dividing, and his extensive knowledge of the most useful instruments in the mathematical line."

Mr. Stancliff's letter commences with a declaration that our "observations on Mr. Allan's instrument," inserted in our last Numbers, "must have had their foundation in prejudice or extreme ignorance, or perhaps both;" and "that he will not enter into any detail or vindication of what he said respecting the great perfection which may be produced by Mr. Allan's plan of racking or cutting the teeth of a circle for dividing mathematical instruments." However, he graciously condescends to say, that "by way of explanation, he will slightly touch on a few points, as a corroboration of his former opinion."

Then, after praising the great utility of the ring in this dividing instrument, he lets fall the whole weight of his ponderous indignation on us in the following words:—"To that extraordinary remark in the Retrospect, saying, 'We can conceive cases in which the effect of the shifting would be to diminish the size of one or more of the teeth each time below that of the rest, instead of equalizing them, and finally to cut some of them away entirely,' I shall make no reply; only that it cannot take place without an error of at least one whole tooth, before the shifting of the ring. Any man that knows the principle of a wheel-barrow, may see the absurdity of this remark in a moment."

After this elegant and very pertinent retort, he proceeds to give some directions for the management of the instrument, in saying, "He hopes it is mentioned in the Transactions of the Society of Arts, that when under the operation of racking or forming the teeth, the ring must, after being reversed or moved 180° once or twice, which will produce correctly all the way round opposite teeth, although unequal in themselves, be shifted one quarter or 90°, and then proceed with the racking and reversing as before, which will in the end, I have no doubt, provided all the work and apparatus concerned is good, produce the number of equal teeth required round a circle, for the purpose of dividing mathematical instruments, probably not yet equalled." The whole of this is confused, but the last sentence is particularly obscure, for it leaves a doubt, whether it is the equal teeth, the mathematical instruments, or the dividing machine, which have been "probably not yet equalled."

Mr. Stancliff then gives us some information on the use of the screw and rack for dividing; which he believes to have been first made to divide a circle all round, by his old master, Hendley of York, about 73 years ago, and says that the instrument of Dr. Hook's, made in 1674, to which we alluded, "was merely a quadrant for the purpose of astronomy, with teeth cut with a screw all the way on the outer edge, not divided into degrees and minutes, but of which the value was to be found afterward; and therefore it was not intended as a machine to divide others with."

Mr. Stancliff next gives directions again for the management of the instrument; and then makes the following observations on our work:—"The Retrospect says you (Mr. Allan) have given no proof, but bold encomiums, on the perfection of your instrument, and denies its self-evidence. I really do not know any greater test that it can be put to than may be done by the ring, which is certainly a part of the machine."

He then states, that he is confident the machine may be made to act without steady pins, or even lines (only a few pencil marks), by contact itself, which Mr. Smeaton says is fifteen times nearer the truth than coincidence; and concludes with these words: "Respecting your (Mr. Allan's) improvements in the dividing engine, by what I have said above, you will perceive that I still support my first opinion, that it is a great and important discovery."

Observations.—In addition to the remarks above quoted, we also observed in our 30th Number, on Mr. Allan's account of his instrument, that "for the reasons (there stated) we must consider the presumed equality of the teeth produced by Mr. Allan's method, to be neither demonstrated nor supported by any circumstances as yet laid before the public; and that until this were done, its merit must remain undecided, and its character must depend solely on the weight, which the opinions of the gentlemen, whose names appear in its favour, have with others; for which opinions also no reasons have been stated." We were in hopes, when we took up Mr. Stancliff's paper, that some explanation would be given of the principle, on which the equality of the teeth is to be produced in Mr. Allan's instrument; or something like a proof, if not a proof itself, that the teeth by it were equally divided: but we are sorry to observe, that our first remark, above repeated, still remains in full force; that no proof of the fact is yet given; and that, not content with the attempt to force an unproved opinion on the public by personal authority alone, Mr. Allan has been so ill advised as to suppose he can compel a favourable opinion of his instrument, by bringing Mr. Stancliff forward to bear us down by the weight of *his* assertions, or that he can refute our remarks by affected con-

tempt of our publication: we say we are sorry, for we have no enmity to Mr. Allan, and our love for the improvement of the arts would have given us a sensible pleasure in seeing a fair demonstration of the equality which he asserts his instrument confers on the teeth, to whose formation it is applied. We have not said this was impossible; but until it be done, no rudeness will compel us to give the sanction of certainty to a doubtful opinion.

As to the obscurity of our publication, asserted by Mr. Allan, we shall only observe, that his acts contradict his words; for if it were so very obscure, could our remarks have been of consequence enough to have engaged him, an obscure individual, to take the trouble he has done about them? or our merely not assenting to the panegyrics on his engine (for we did not condemn it), irritate him and his friend, as, from their observations, evidently has been the effect?

Mr. Allan might be excused for feeling vexed at meeting disappointment, where perhaps, in sanguine partiality for his invention, he anticipated praise; but we are surprised at the irritation of his friend; and it is not a little arrogant in Mr. Stancliff, who does not stand in the first rank as a man of science, to expect that his name alone should force the public to give their decided approbation to an assertion on a subject, which being of a mathematical nature, of course admitted of absolute demonstration.

Our mention of Dr. Hook's instrument was merely with regard to the priority of his invention of the mode of dividing by a rack and screw, as we have expressly stated; and had nothing to do with any comparison of it with Mr. Allan's instrument in other respects. What is said on this subject, is the only part of Mr. Stancliff's paper that requires any serious reply: we have searched it carefully for any thing like argument, and can find none; we are still referred to personal opinion, to his experience and high pretensions, and if to any thing more it is to experiment only; but all shadow of mathematical proof is totally wanting; and the mode of arguing, if mode it can be called that is destitute of all form, is precisely of the nature of Lord Peters, in the Tale of a Tub, when he demonstrated that bread was mutton, by damning those to all eternity who thought otherwise.

AGRICULTURE.

FIORIN GRASS.

Memoir on the Fiorin Grass, by Mr. ROBERT AINSLIE, *Writer to the Signet, read by him to the Agricultural Society of Kirkcudbright.—Farmer's Magazine, No.* 49.

Report from the Committee of the Agricultural Society of Kirkcudbright appointed to visit Dr. Richardson in Ireland.—Farmer's Magazine, No. 50.

Letter from Dr. RICHARDSON, *of Clonfeckle, Ireland, to* WILLIAM HERRIES, *Esq. Preses of the Committee of Management of the Agricultural Society of Kirkcudbright, containing Observations on the preceding Report.—Farmer's Magazine, No.* 50.

THE connection of the three articles on fiorin grass, which are above-quoted, has induced us to notice them together; indeed the Conductor of the Farmer's Magazine intended the same arrangement, but was precluded by the nature of his publication.

The memoir of Mr. Ainslie was submitted to the Kirkcudbright Agricultural Society in 1811, and having been printed at the Society's request, became known to Mr. Curwen, with whom Dr. Richardson was then on a visit at his seat in the North. Mr. Curwen had been a sceptic as to pre-eminent value of fiorin grass, as contended for by its admirers, and was induced to change his opinion by Mr. Ainslie's memoir, which he deemed a perspicuous paper, and he thought ocular demonstration only was wanting to make the proofs complete. To effect this purpose, and to avail himself at the same time of an occasion of an avowal of his former errors, Mr. Curwen accompanied Dr. Richardson on a visit to the Society at Kirkcudbright in the autumn of 1811, when, at the Doctor's request, Mr. Boyd of Merton Hall, and Mr. M'Culloch of Ardwall, were appointed a committee to proceed to Clonfeckle, and to present a report of the observations they should make; on which report the original patron of the *fiorin grass* thought proper to offer the remarks contained in the letter which concludes these papers.

Such is the history of the papers which we thought it right to lay before our readers previous to commencing an examination of their separate contents.

Mr. Ainslie, after noticing that the fiorin had been brought into notice by Dr. Richardson, and relating the circumstances which more particularly called his attention to it, states that it is of the genus called Agrostis, and is by Linnæus specifically named *Agrostis Stolonifera*, on account of the great quantity of stolones or shootings which it sends out; and though in Ireland called *fiorin*, is the same grass as is known in Scotland by the name of *creeping bent grass*. He observes, that all the fields in his neighbourhood, particularly in moist situations, abound with it, though it is seldom seen in perfection, from its being cut down in its natural state. The most remarkable circumstance respecting it being, that it puts forth a great profusion of lateral strings, like the strawberry, which Nature designs for propagation; the root consists of a number of small fibres, not thicker than silk threads, and not more than an inch and a half long; penetrating into the earth but a little way, and taking but slender hold of the soil. From its near resemblance to the *quicken*, a noxious and exhausting grass yielding herbage of the worst quality, the difference is pointed out as consisting more in the root than the appearance of the herbage, for the root of the *quicken* is long and tangled, while that of the *fiorin* is very slender and simple.

After this description, the memoir proceeds to notice the *qualities* which this grass is understood to possess; which are, 1. That it grows luxuriantly in low and swampy grounds and mosses, which, but for the cultivation of it, would be of little or no value; 2. That it grows in very great quantities; the most favourable situations, which are irrigated meadows, having been known to produce above four times the weight of any single crop, which is in general reared of any other grass; 3. That all horses, sheep, and cattle, are extremely fond of it, and actually prefer the hay which is made from it to any other hay whatever; 4. That from the nature of this grass, and the length of time which it annually vegetates, it may be used with much advantage as green food during the greatest part of the winter; 5. That it may be made into hay during the winter, and whether the season is wet or dry.

In support of the actual existence of these qualities, authorities are quoted from numerous publications, which however refer chiefly to the grass, as constituting part of the herbage of meadows properly so called; and it is observed, that Dr. Walker, in the Transactions of the Highland Society, mentions it as a natural grass upon moss, which was also confirmed to the author by a letter from the Secretary to the Caledonian Horticultural Society at Edinburgh. Many instances are adduced of the quantity produced on different occasions, from which it would seem that the produce was not less than five tons to the acre (it is presumed the Scotch acre): and these instances are considered sufficient to establish the fact of the

very great quantity of this grass which may be produced on any given portion of land.

The next quality adverted to is, that all horses, cattle, and sheep, are remarkably fond of it: and this is shewn from the affidavits of many persons in each part of the united kingdoms; and its influence in improving the flavour of milk is pleasantly detailed in an anecdote communicated by Dr. Richardson to Lord Hertford. The strings of the fiorin are said to preserve their vegetable life for a long time after they are separated from the ground, preserving thereby their saccharine juice, and giving a most agreeable flavour to the hay; and for this reason also the hay will not rot, as common hay, when long exposed to wet weather; and therefore it may be cut at any period of the year, even in the midst of winter.

The mode of culture of fiorin is but slightly noticed in the memoir, but is more particularly described in an Appendix, in a communication from Mr. Miller of Dalswinton, who had laid down with this grass thirteen acres of a peat bog, from which peats had been cut many years, and which had been previously let for 15*s.* per acre, but which would not now be let for 200*l.* per annum. Mr. Miller allows that the laying down of this ground cost him a heavy expence, but that it proceeded in a great measure from its requiring much levelling, owing to its having been formerly cut for peats, and from its being too soft to bear horses, so that it became necessary to prepare it with the spade. As to the time and mode of planting it, he says, "Fiorin may be laid down in the months of September, October, and November. I begin with draining where requisite, as the ground should be made completely dry: if the ground to be laid is ley, it should be summer-fallowed, and all the stones, root-weeds, and other rubbish, carefully gathered and carried off. When the ground upon the surface is well pulverised, the grass may be scattered upon it. I sometimes lay it down by sprinkling the strings uncut upon the surface, sometimes I employ women to twist the strings into loose ropes about the thickness of the arm, which are cut by other women with a hedge-bill upon a plank into lengths of three and an half inches, which cuttings I sprinkle upon the surface; at other times I sprinkle with those cuttings and scatter whole strings over them. When this work is done, the grass should be covered with a slight top dressing of lime and free earth well mixed and pulverised, or with peat-ashes and earth well mixed: the ground if then dry should be rolled with a wooden roller, and it must be completely and sufficiently inclosed to keep out cattle and sheep: the land laid down with fiorin the preceding year, should be carefully weeded by hand twice or thrice in the following summer months; and if this be carefully done, there will be no occasion to weed again." These directions are allowed by the author of the memoir to be very valuable; and he adjoins, in continuation of the directions there given, that the fiorin

should be laid on the ground very thick, as otherwise there will be little or no crop obtained the first season.

Mr. Ainslie concludes his memoir by remarking, that it is not merely by increasing the quantity of animal food that the beneficial effects of the cultivation of fiorin grass would be felt, for it must also indirectly much enlarge the quantity of grain, which the soil of the kingdom would produce by the production of a great quantity of manure, and by the land hitherto waste being applied to the feeding of cattle, which would leave much ground now employed for that purpose at liberty for the production of corn.

The Report of the two gentlemen appointed by the Kirkcudbright Society to visit Dr. Richardson's farm, states that they proceeded to Clonfeckle, where they minutely examined his cultivation of fiorin grass, of about fifteen acres in extent. In this quantity of surface they found a variety of soils, as deep rich loam, stiff cold clay, thin poor gravel, and bad peat moss. In a field of six acres formerly natural meadow, the Doctor began to mow on the morning of their arrival, and on the third day the grass was in lap-cocks, and the appearance of the whole surface resembled the produce of twenty acres of excellent meadow. The reporters insist, after the most careful examination, and in the purest spirit of conviction, that there was on that given extent of surface four times as great a quantity of produce, as they ever saw cut from the most valuable meadows. This field had been planted in a poor state in December 1809. The attention of the committee was next called to a thin poor gravelly soil, partly under irrigation; and here the abundance of the crop was equally apparent from what remained, though a considerable part had been carried off. The next object was a sloping bank, ill calculated, from its steepness and poverty of soil, to produce profitable vegetation of any description; and in this field the crop was stated to have been made equally considerable, by a top-dressing with miserable compost. The gentlemen directed their attention in the last place to the cultivation of fiorin on peat moss, which gave them the most unbounded satisfaction, inasmuch as from that moment they felt convinced, that through the exertions of Dr. Richardson, there was a prospect of seeing at no remote period several millions of acres, which are now worthless mosses, brought into as productive meadows, as the most valuable of the natural meadows; and of this being effected at so small an expenditure of money, as not to be beyond the prudent exertions of a tenant.

They returned from Clonfeckle with a full conviction, that fiorin grass possessed every merit attributed to it in the memoir of Mr. Ainslie; and they recommended the cultivation of it in the strongest terms to every member of the Society.

The letter of Dr. Richardson fully confirms every part of the

preceding statements, and affords some elucidations of his method of planting and culture, but they vary in too inconsiderable a degree from those laid down by Mr. Miller, to deserve a particular notice.

Observations.—These papers appear to us to contain an epitome, nearly perfect, of all that has appeared on the subject of fiorin grass. An account of their origin will be found at the commencement of the article; and it only remains for us to recommend an attentive perusal of the whole to all farmers, who would cultivate the fiorin, particularly on bogs and mosses.

On a New Method of cultivating White Crops. By the Rev. Mr. CAMPBELL, *of Kilcalmonell. — Farmer's Magazine, No.* 49.

MR. CAMPBELL forms his land into ridges, exactly as if intended for potatoes or turnips, and levels it with the harrow; a breadth of six or twelve inches, or any intermediate space on the middle of each is then sown, which may be done by a machine similar to the turnip drill-barrow, and constructed so as to sow two or more ridges at once. The double mold-board plough, by passing between the ridges, throws over the seed the earth drawn into the intervals by the harrow: the ridges are then rolled, and horse-hoed through the summer.

It is observed, that potatoe land may be made into two feet and a half ridges, as soon as the potatoes are taken up; and the ridges and furrows from which hoed oats, beans, turnips, or cabbages, have been removed, may be reversed, and left in that state till the following sowing. The expence of cultivating a field in hoed ridges is reckoned not much to exceed that of the alternate system of broadcast for white crops, and hoed ridges for potatoes, turnips, beans, &c. Mr. Campbell universally recommends a plentiful allowance of seed.

Some calculations, and tables of expences then follow, from which it would seem, that the produce of drilled and hoed crops exceeds that of crops sown broadcast.

Observations.—The mode recommended by Mr. Campbell, for the cultivation of crops of white grain, appears at first sight rather specious; but we do not conceive that it will be found practically useful for any length of time; because unless it would supersede the necessity of summer-fallows, which we do not see reason to expect the cost of hoeing and weeding will exceed the amount of the increased produce.

On a New Mode of Irrigation, and the Value of Peat Moss as a Soil. By the Reverend WILLIAM RICHARDSON, D. D.—*Farmer's Magazine, No.* 49.

THE new mode of irrigation here recommended is, to continue laying on the water at intervals through the summer, as long as the waters last, and to resume it when autumnal rains, or occasional floods again restore them, and to abstain from mowing till October is well advanced.

The Doctor boldly advances it as his opinion, that a peat soil, instead of the natural sterility which has been generally attributed to it, possesses a natural richness which it is easy to call forth to advantage: the sterility or productiveness of peat moss is considered to be a fact to be decided on by the agriculturist on the spot, and not by the chemist in the laboratory.

Observations.—It would be difficult to form a conjecture as to the object of Dr. Richardson in this publication, was it not for the censures thrown out against Dr. Rennie, for his chemical investigation of the nature and properties of peat moss. We cannot, however, so far lend ourselves to what appears a private motive, as not to mark the present article with our strongest censure.

Description of the Diamond Harrow, invented by the Rev. Mr. CAMPBELL, *of Kilcalmonell.—Farmer's Magazine, No.* 49.

IT is not very easy to convey an adequate idea of this harrow, without the assistance of a plate, which accompanies the original paper. It differs however from the common harrow in shape, chiefly in the sides ending in a lozenge point, like the panes of a diamond window, instead of being straight, and in the timbers being framed together in that position; by which means the teeth are so placed as to move over the ground in equidistant and horizontal lines.

Observations.—Though we readily allow much merit to this implement, yet for very rough land we must give a preference to the harrows made by Mr. Lester, the teeth of which are also equidistant, but so placed as to admit large clods at the commencement of the harrow; and the clods are completely broken before they can escape at the further part.

Remarks on Mr. WILKIE's *Iron Plough. By a* MECHANIC.—*Farmer's Magazine, No.* 49.

Comparative Expence of the Iron and Common Ploughs; by the same.—Farmer's Magazine, No. 49.

THE writer expresses his entire satisfaction, that malleable iron is calculated not only for the construction of the plough, but also, for the greater part of agricultural implements. And he proceeds to offer some remarks on the iron ploughs made by Mr. Wilkie, and points out some improvements, which appear to contribute to the strength without adding to the weight of the implement.

The first cost of an iron plough is stated to be five guineas, and it is supposed to last 21 years, while a common wooden plough, which performs the same quantity of work in a year, would be useless in the course of three years; and as far as regards those parts which are subject to wear, it is thought that the expence of maintaining the iron plough in proper repair will be nearly the same as that of the wooden plough, and will entirely depend upon the soil. Reckoning the original cost of the wooden plough at 3*l.* 10*s.* and the wooden part of it to be six times renewed in 21 years at the expence of one guinea each time, the calculation is (including interest on the respective sums advanced) that the advantage in point of expence possessed by the iron over the wooden plough, is in the proportion of two to one.

Observations.—We agree with this writer in the opinion, that malleable iron may be very advantageously used in many agricultural implements, to which it has not been hitherto applied; and we conceive, that ploughs made entirely of that metal, will not only answer every purpose of the wooden plough, but may, at no very remote period, almost supersede the use of them.

Of the Difference in the Effect of Dung upon different Soils, and upon the same Land, before and after it has been Limed. By Mr. WILLIAM DAWSON, *of Edinburgh.—Farmer's Magazine, No.* 49.

THIS writer commences by noticing the general admission that dung produces much greater effect upon good than upon bad land when in tillage; but adds, that the difference of its effects upon different kinds of land when in grass, though much more considerable, had been but little observed. He states, that an accidental circumstance directed his attention more particularly to these consequences.

Having occasion to carry away a quantity of very fine black loam from a head-ridge of old land, to give the surface-water a free passage, it was laid upon benty grass land adjoining, of which it covered a rood about a quarter of an inch thick; no grass-seeds were sown upon this new covering, yet white clover, and other fine grasses sprung up and gradually increased upon it, and the bent upon which the loam was laid diminished so speedily, that very little of it remained in the third year afterwards. A few years after this, having a considerable extent of land in fallow, which he wished to lime previous to its being laid down to pasture, but not obtaining a sufficient quantity of lime, he was induced to try a small quantity of lime on the surface of a part of this fallow, instead of a larger quantity ploughed down in the usual manner. Accordingly, in the autumn it was well harrowed, and then about fourteen bushels per acre were carefully spread upon it, and immediately well harrowed in; and the pieces of lime, which had not been fully slacked at first, were gradually reduced to powder by the dews and moisture; and, to mix this with the soil, the land was again harrowed in three or four days afterwards. In the spring, oats were sown with red and white clover, and rye-grass seeds, and well harrowed without being ploughed again; the crop of oats was good, and the plants of grass sufficiently numerous and healthy, and formed a very fine pasture.

Similar treatment was subsequently given to more land with similar success, and in all these instances, where the lime was only harrowed in, and not ploughed down, the land not only continued to produce the fine grasses, but the dung of the animals feeding upon them had the same effect in increasing the quantity and verdure of the grass, as it has upon rich loamy soils; whereas, whenever the lime was ploughed down, the parts of the soil at the surface, which were not sufficiently mixed with lime, though sown with clovers, became gradually covered with bents, and the dung of the animals had little or no effect upon such benty parts.

Mr. Dawson notes it as an obvious circumstance, that animal dung has little or no effect upon benty pastures, since in all hilly countries there are great tracts of such grass land, which have continued for centuries, though constantly depastured with cattle and sheep, without any visible improvement; the animal dung neither increasing the quantity nor improving the quality of the pasture; and he considers it yet more remarkable, that dung has no permanent effect upon such soils, even when ploughed down; for about five acres of earthy benty land were folded with sod dikes, and very well dunged, with an intention of ploughing it for oats, but this intention was relinquished, and the dykes thrown down in the spring, well harrowed, and sown with rye-grass; the effect of the dung upon that land was very considerable the first year, less the second, and was scarcely perceptible beyond the third.

In order to shew that the effects of dung upon this sort of land are much greater when the soil has been previously mixed with lime, as well as much more permanent, the following facts are adduced: fifty bushels of unslacked lime per acre were laid on dry benty land, which was cropped with, 1. Turnips; 2. Barley or oats; 3. Grass; and 4. Wheat. It was expected that this mode of cropping would not exhaust the land, but in the second year, the crops were much inferior; and on the greater portion the grasses sown were an equal quantity of red, white, and yellow clover, with a small part of rye-grass; the surface soil was well mixed with lime; and on this part the clovers were not afterwards injured by the native bent; and the dung of sheep folded upon it, greatly increased the quantity and richness of the pasture; and after remaining six years in grass, it was ploughed up, and produced great crops of corn.

From these statements the following inferences are drawn: that animal dung dropped upon coarse benty pastures, produces little or no improvement, and that in case of folding, their dung ceases to produce beneficial effects after a few years, whether the land is continued in pasture or brought under the plough: that when land of this description is well fallowed and dunged, but not limed, the dung only augments the subsequent crop of corn, and the grasses for two or three years: that when this land is limed, and the lime kept upon the surface of the soil, or well mixed with it, and then laid down to pasture, the finer grasses continue in possession of the soil to the exclusion of bent and fog: that when a large quantity of lime is ploughed down deep, the same effects will not be produced, either with respect to the fineness of the pasture, its gradual amelioration by the dung of the animals depastured on it, or its fertility when afterwards in tillage.

Observations.—As these inferences are the result of long and attentive experience, we earnestly recommend the paper both to the consideration and the practice of our agricultural readers.

An Account of a Method of collecting and applying the Urine of Cattle as a Manure to Land; with a Statement of the Expence and Value. By Mr. CHARLES ALEXANDER, *Farmer, near Peebles.—Farmer's Magazine, No.* 49.

THIS account is contained in a letter addressed to Sir John Sinclair, which gives also some description of the manner in which the farm buildings are placed, which is such that the urine from all the stalls is conveyed by trunks to a dung-pit, and the dung is laid in a place appropriated for that use, instead of being thrown into the middle of the yard, according to the usual practice. The dung-pit is twelve yards square, and four feet deep, and is filled

with mold previously carted into it for the purpose of being impregnated with the urine, and the moisture from the dung. This pit produces about 288 cart-loads, forty of which are sufficient for an acre. The dung itself is laid on the land in the common way; but the compost made by the urine, &c. with the mold is spread on the surface after ploughing, and is merely harrowed in. The expences of filling the pit is calculated at about 6*l.*, and 192 yards of dung, at 3*s.*, amounts to 28*l.* 16*s.* So that the advantage of the method is too obvious to be mistaken. Mr. Alexander dungs for turnips; and usually pursues the following rotation of crops; viz. 1. Turnips; 2. Barley with grass seeds; 3. Grass cut for hay and soiling; 4. Pasture; 5. Pasture; 6. Oats; 7. Peas; 8. Oats; and then return to turnips.

Observations.—We have too often noticed with regret, the negligence of farmers, in suffering the drainings of their yards, and the urine from their cattle-sheds to be wasted, not to be fully sensible of the advantages resulting from the method pursued by Mr. Charles Alexander; and Sir John Sinclair merits the thanks of farmers for communicating this article to the magazine.

Thoughts on Harvest Management. By J. G. F.—Farmer's Magazine, No. 50.

The management recommended, is to place the knots of the sheaf-bands all innermost in the stock or shock, instead of placing them exposed to the weather, as in the usual method; and to place the shocks themselves in the direction of S.W. and N.E. by, which mode it is believed that the shocks would have less chance of suffering from the effects of bad weather, as they would generally be end-ways to the storm, and the rain would not be retained in the knots of the sheaf-band.

Observations.—There is something too fanciful in this management, for it to be attended to in general practice; but it may perhaps have its utility in the most northern parts of the island.

On the surest Means of improving the Breeds of Sheep and the Quality of Wool. By the Ettrick Shepherd.—*Farmer's Magazine, No. 50.*

The Ettrick Shepherd recommends the improvement of the original breeds of each district or farm, rather than the too common practice of bringing a costly stock from a distant county, and from

a soil and climate in every respect completely different; since every practical farmer knows that the removal of a flock of sheep to another farm, even in the immediate neighbourhood, is often attended with the most fatal consequences; this incongruous method of changing all at once having, instead of forwarding the improvement of wool, tended to impede it, and the animals having been hurt or ruined by the experiment.

And, as the form of the sheep and quality of the wool depend three fourths on the ram, he would draw the attention of his countrymen to the more sure and more natural method of improving their breed by the introduction of improved rams, rather than by expending an exorbitant sum on a stock, one half of which they may lose before it becomes naturalized to the soil. The unwillingness of the Scotch farmers to the introduction of Cheviot sheep, and their predilections for an unmixed breed, are combated with much ingenious argument; and they are asked whether they would prefer having five or seven fleeces weigh a stone, and whether they would prefer seven or twenty shillings for that weight of wool?

By such reasoning the author endeavours to make converts to his opinions; and to such farmers as cannot endure any other sheep than those which have black faces, he recommends a cross breed between the Scotch and South-downs, which is a very handsome animal resembling the native Galloway sheep. He considers crossing the breeds the most effectual way of improving the wool, and ameliorating the carcass at the same time; and remarks, that as soon as the fine-woolled sheep are a week old, they are generally as healthy and as hardy as the coarse woolled ones, if once they are naturalized to the ground, and become natives of the soil.

Observations.—These sensible remarks of the Ettrick Shepherd claim the attention of all farmers desirous of improving their breed of sheep, and are more particularly important to those who are situated in the more northern parts of the island.

Description of a Machine for Hummelling Barley and Bear, invented by Mr. GEORGE MITCHELL, *of Bishop's Mill, near Elgin.—Farmer's Magazine, No. 50.*

THE machine consists of a cylinder, in which bars crossing each at right angles are revolved round an axis; the barley or bear is put into the cylinder, and the awns are separated from the corn by the rotatory motion of the axis to which the bars are fixed. It may be annexed to the horse-wheel of a thrashing or any other machine.

Observations.—Though we cannot entertain a doubt that the machine is adequate to effect the purpose for which it is designed, yet we apprehend the expence to be incurred in the purchase and subsequent working, would more than counterbalance the advantages gained. We could not convey a more perfect description without the help of the plate, which accompanies the original communication.

On the Application of Bones as a Manure to Land. By a Correspondent at Edinburgh.—Farmer's Magazine, No. 50.

It is stated that bones are collected with much care and industry in the fields near Edinburgh, and are shipped for Hull, where they are used for knife-handles, button-molds, and for manure. At Hull a mill is constructed for the purpose of bruising bones for manure, which are sold at 1*s.* 1*d.* per bushel, and the dust riddled from them at 2*s.* 3*d.* being reckoned of a stronger quality. Bone manure is said to be used in the west of Yorkshire, Holderness, and Lincolnshire, and to be best adapted for cold and light sandy soils; the usual quantity seventy bushels per acre, but when mixed with ashes or common manure, thirty bushels per acre. It is applied in the same way and at the same periods, as other manure, and its effects will continue seven years.

Observations.—When it is remembered that bones, according to Fourcroy, consist almost entirely of calcareous phosphat, there is nothing strange in their making a very valuable manure; and the reason why the powder sells for more money per bushel than the bruised parts, is to be accounted for from the pulverized particles mixing more intimately with the soil than larger pieces.

On the Advantages of Liming Coarse Pastures. By a Plebeian.—*Farmer's Magazine, No.* 50.

The writer states that about five years ago, he spread about four hundred bolls of lime hot from the kiln, upon five acres of soft ground, all covered with heath, rushes, sprits, bent, and other coarse grasses; the lime was laid on in the month of September, and by the next spring he saw a visible improvement in the grass; the next year cattle fixed so greedily upon it, and other land which had been treated in the same manner, that they fed upon it exclusively, the greatest part being mixed with sweet grasses and white clover. He also laid lime upon a hard gravelly soil, where nothing grew but heath, but here it had little effect. He conceives, how-

ever, that good compost made up of heavy soil and lime, and well mixed, so that it may be the more equally spread, would amply repay the expence and labour upon any coarse grass land.

Observations.—Perhaps the most advantageous mode of using lime is by mixing it with other manures, and then using the compost as a top-dressing, instead of ploughing the lime deep into the soil; in the latter method of application many failures have occurred, but an extended experience bears testimony to its uniform benefit, when applied in the way recommended in this paper.

On Draining the Bogs of Ireland; in a Letter to the Earl of Selkirk, By WM. RICHARDSON, *D. D.—Agricultural Magazine, No. 55.*

Essay on the Great Irish Bogs, and their Natural History, with a Discussion of the Opinions on their Original Formation, and the Author's Plan for reclaiming them; also, some Observations on the Measures to be pursued for the Purpose, according to the tenor of a late Act: addressed to the Earl of Selkirk, By WM. RICHARDSON, *D. D.—Agricultural Magazine, No. 56, and 57.*

Appendix to Dr. RICHARDSON'S *Essays on the Great Irish Bogs, &c. By* WM. RICHARDSON, *D. D.—Agricultural Magazine, No. 58.*

Remarks and Queries on Dr. RICHARDSON'S *Mode of Draining Bogs. By* CULTIVATOR MIDDLESEXIENSIS.—*Agricultural Magazine, No. 57.*

IT will be in the recollection of our readers, that in consequence of a parliamentary recommendation, a royal commission was prepared in 1809, for enquiring into the extent and best means of improving the bogs in Ireland. Among the gentlemen appointed Commissioners on this occasion was Dr. Richardson, who had brought himself into public notoriety by his publications on fiorin grass. The Commissioners made to Parliament, two voluminous reports in the following years, in the framing of which, however, Dr. Richardson does not seem to have concurred with his colleagues.

It would be impossible for us, in our contracted limits, to give any tolerably fair account of two folio volumes, to which the reports extend, and without such an account a particular analysis of the Doctor's essay would be very unintelligible; and as Parliament cannot enter into any controversy, we can hear only Dr. Richardson's side of the question.

We prefer therefore confining ourselves to announcing the pub-

lication of the essay and the introductory letter, to attempting what is beyond our means to accomplish; adding, however, in justice to Dr. Richardson, that we coincide with him in the opinion, that rendering the great bogs of Ireland private property, will accomplish their improvement more speedily than any measures whatever at the expence of the public.

On the Prejudice of some English Farmers against Fiorin Grass, in a Letter to I. H. Scott, Esq. By WILLIAM RICHARDSON, *D. D.—Agricultural Magazine, No. 55.*

On Fiorin Grass. By J. J. of Northamptonshire.—Agricultural Magazine, No. 56.

On Fiorin Grass, By Mr. J. LAWRENCE.—*Agricultural Magazine, No. 57.*

Answer to J. J. on Fiorin Grass, By WILLIAM RICHARDSON, *D. D.—Agricultural Magazine, No. 58.*

On Fiorin Grass. By Mr. J. LAWRENCE.—*Agricultural Magazine, No. 58.*

On Fiorin Grass. By A BERKSHIRE FARMER.—*Agricultural Magazine, No. 59.*

THESE papers on the same subject may be better considered collectively, than by a separate notice of each. It need not be here repeated, that fiorin grass is a very favourite child of Dr. Richardson, and that to entertain any doubts of its fecundity or utility, is considered by him as encroaching on the sanctuary of the Temple. All the papers not written by that gentleman, without denying the accuracy of his statements respecting Irish crops, presume to think, that it is not equally fertile on this side the Channel; and Mr. Lawrence proves from facts, that fiorin hay is not more exempted from mould than other hay; and it is more than insinuated, that a copperplate picture may be more beautiful than the original object. Dr. Richardson turns up his nose, and exclaims, "*Prejudice of ignorant Farmers!*" If any of our readers wish to read the controversy, they will find more sarcastic observation than useful knowledge in the original papers.

On the Resp in Sheep, By Mr. JOHN LAWRENCE, *of Somers Town.—Agricultural Magazine, No. 55.*

THIS paper is nothing but a whining complaint against the author of "An Enquiry into the Nature and Cause of the Resp in Sheep," a pamphlet published by Harding in St. James's-street; for Mr.

Lawrence insists that the whole of the pamphlet has been pirated from his publication on cattle.

Observations.—We have noticed this paper the more willingly, in order to avail ourselves of the occasion of reprobating in the most decided terms the species of literary piracy here complained of, which we are determined to expose whenever it attracts our notice.

Description of Mr. Gardner's (of Banbury) newly-invented Turnip-Cutter.—Agricultural Magazine, No. 55.

In this machine the knives are fixed in the back part of the hopper, and the turnips are pressed against them by curved pieces of solid iron fixed on the axis of the toothed wheel, which as they revolve draw in the turnips and press them against the knives, which cut them into irregular pieces, and not into slices, and the pieces fall out on the ground through an aperture in the bottom of the hopper. The machine itself is fixed against any strong post, and has a winch, fly, &c. like a hand-mill.

Observations.—This machine appears to us to be entitled to a preference to every other of the kind, which has been yet offered to the public; and we can confidently recommend it to all who feed their cattle on turnips, on account of the simplicity of its construction, which renders it not liable to get out of repair, and the ease and expedition with which it performs its work.

On Buck-wheat Bread, Potatoes, &c. as a Substitute for Bread. By L.—*Agricultural Magazine, No. 55.*

The writer observes that brank or French wheat, as it is called, is frequently used as bread-corn in France and Italy, though he cannot recollect any similar application of it in England; though he conceives it might be advantageously applied to that purpose in times of scarcity, since he has used it to a very considerable extent as food for animals, with uniform success.

He manufactured buck-wheat, dividing the flour into firsts, seconds, and thirds: a loaf made out of the firsts possessed a flavour and quality, which put an end to all doubts as to the value of buck-wheat for human food; for though extremely brown, it yet possessed an aromatic flavour, and retained the flavour of the buck-wheat when chewed in a raw state. He however considers all other substitutes for bread as inferior to potatoes, though he deems these

most proper to be used by the opulent classes, that the more solid nutriment of good wheaten bread may be left for the laborious classes.

Observations.—The sensible remarks in this paper are evidently the result of both attention and experience; and we regret that they are given to the public only with the recommendation of an anonymous signature.

On Land being tired of Clover. By C. M.—*Agricultural Magazine, No.* 55.

A PARTICULAR description is given of two pieces of clover, one of seven, the other of two years' standing, both of which were miserably bad. This circumstance, however, is attributed by the writer merely to the exhaustion of the soil, for he does not seem to allow of any other cause why clover should not continue to flourish in fields where it has before succeeded.

Observations.—It is certainly true, that the failure of clover, after it has been repeatedly sown in the same field, cannot be sufficiently accounted for on any philosophical principles; but we do not conceive this a sufficient cause for maintaining the impossibility of the thing, when experience has shewn the contrary in almost every instance; for ourselves, we own we are much more ready to bow to the instructions of that unerring Teacher, than to refuse our belief of whatever we cannot comprehend.

On Turnips and other Vegetables as Food for Cattle. By OLD SUFFOLK.—*Agricultural Magazine, No.* 57.

THE writer commences his remarks by denying the superiority of turnips in producing beef and mutton in the spring, over the cabbage tribe, potatoes, or carrots; without however detracting from the merit of the turnip, he proceeds to notice the properties of the carrot, the soil best suited to its growth, and the uses to which it is applied.

He states that the orange carrot is the only one proper for field-culture, as also most nutritive and beneficial for horses, cows, and sheep; this variety of the root having the flesh more saccharine, and rising in growth to nearly double the size of the pale yellow species.

The soil reckoned most proper for the cultivation of the carrot is the rich deep sandy, the black and deep vegetable, and the sandy

loams; in Suffolk and in Norfolk it is generally sown after turnips (when eaten off in February), barley, and pease; and as soon as the plants appear distinctly, they are hoed to about the distance of six inches asunder, and about a fortnight after are harrowed, which operation displaces and checks the weeds, and at the same time draws fresh earth to the plants; and a second harrowing at a few weeks' interval is also extremely beneficial; and in wet seasons even a third harrowing. The crop is usually fit to take up in September. When the carrots are taken out of the ground, and have remained in the open air till they are perfectly dry, they are stacked in a barn or outhouse, and secured from frost by a good covering of straw; the tops being given to cows, sheep, or swine. Many farmers, however, pursue a less expensive, though certainly a less judicious method, and only dig them out of the ground as they are wanted for use.

The value of the crop is estimated differently, according to the use to which it is applied. The writer states that they may be given to sheep with great success, as an acre of a good crop will fatten twenty head of sheep in less than four months; he thinks them also useful in fattening oxen, and for cows in milk superior to any other winter food, as they greatly increase the quantity of the milk, and at the same time improve the quality of the butter. Swine are also found to do well upon carrots, and likewise horses, when they have at the same time a moderate quantity of corn.

The only root admitted to have any pretensions to stand in competition with carrots is the potatoe, and the preference is still given to the carrot, on account of the expence of preparing the potatoe for use by steaming.

Observations.—There can be little doubt that the carrot is quite equal to the turnip, considered merely as a food for cattle; and when to this is added its more easy preservation from frost, it may be safely recommended as a general object of culture for winter food.

RETROSPECT

OF

PHILOSOPHICAL, MECHANICAL, CHEMICAL AND AGRICULTURAL DISCOVERIES.

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NATURAL PHILOSOPHY, ARTS, MANUFACTURES, AND CHEMISTRY.

Experiments on the Resistance which the motion of Air undergoes when confined in very long Pipes; by Messrs. LEHOT, DESORMES, and CLEMENT.—*Jour. de Phys. for July*, 1811.

THESE experiments were suggested by that of the late Mr. Wilkinson, related in our last Number (p. 60), the accuracy of which these gentlemen totally deny. As the subject is curious we shall give some of the circumstances.

In one of the galleries of the canal of L'Ourcq are two series of parallel iron pipes, slightly curved, 25 centimetres (9.84 Eng. inches) in diameter, and 447.5 metres (1468 Eng. feet) in length. One end of one of these pipes was closed with a cork perforated in the middle to receive the nozzle of a small pair of bellows, and a candle was placed at the other end. A person struck the closed pipe with a hammer, and worked the bellows at the end of the pipe at the same instant, and the flame of the candle, at the further extremity, was observed to turn aside the moment that the sound of the stroke was heard. A ventilator, on Desaguiller's construction, one metre in diameter, was substituted to the bellows, its orifice was connected with the tube; a sound was articulated at the instant that the machine was set in motion, and an observer,

placed at the extremity, saw the flame of the candle inclined at the same instant that the sound reached him. It was remarked, however, that though the transmission of air through the tube was extremely rapid, it did not acquire its utmost velocity till a considerable number of seconds had elapsed, as was shewn by the inclination of a small anemometer; and if the ventilator was suddenly stopped when the current of air had reached its utmost velocity, 67 seconds elapsed before the current became insensible. The utmost velocity thus produced, as ascertained by the anemometer, was reckoned at 4 metres (13 ft. 1½ in. Eng.) per second.

The current of air is thus rapidly established, not only when the further extremity of the tube alone is open, but also when a lateral orifice is made in the tube close to the ventilator. In this case, each orifice being reduced to the same diameter, and an anemometer being placed at each, that at the orifice, close to the ventilator, shewed a velocity of 2.75 metres, and that at the further extremity indicated 1.62 metres per second.

The authors make the following remarks upon these experiments:—"We have thus found that a pressure equal only to 2 "or 3 millimetres of water was able to establish a considerable "current of air, in a pipe of large bore, sufficient to blow out "a candle at 447 metres (1468 feet) distance, and that the ve- "locity of the air was equal to that of transmitted sound; "whilst, on the other hand, Mr. Baader (the relator of Mr. "Wilkinson's experiment) asserts that the whole force of a hy- "draulic wheel, which may well be reckoned equal to two "metres, or 1000 times as much as in our own experiments, "was unable to stir the flame of a candle at only 200 metres "distance in a much larger pipe than that which we employed. "Mr. Wilkinson therefore must have been misled by some un- "accountable accident."

The authors of this paper took this opportunity of measuring the velocity of sound conveyed through the air of the pipe, which was found to be equal to 1015.6 English feet per second, at 54½ therm. and 29.92 bar. The rate of the transmission of sound, by percussion of the metal pipe, was 1945 feet per second.

Observation.—Though we cannot doubt the accuracy of these experiments, it is also equally difficult to attribute the different result of Mr. Wilkinson's to any error of observation, considering all the circumstances. It should be remarked, also, that the entire length of Mr. Wilkinson's pipes was 5000 feet, or between three and four times as great as that of the French experiment; the distance of only 200 metres, to which these gentlemen refer, relating merely to the lateral holes which were

drilled in the iron pipes by Mr. W.'s direction, after the impossibility of establishing the current through the whole length of iron pipes was fully ascertained.

On the Manufacture of Gunpowder. By MM. RIFFAUT *and* BOTTÉE, *Inspectors of Powder and Saltpetre. Extracted by* M. VAUQUELIN.—*Ann. de Chim. tom.* 82.

THE great importance which is attached to this publication by M. Vauquelin, who has thought it worth while to give a detailed abstract of its contents, chapter by chapter, has induced us to mention it in this place, as a perusal of the original work may perhaps furnish some valuable hints to the manufacturers of this article, which is of such vital importance to the security of every civilized country.

The first chapter contains a chemical history of nitre, of the countries in which it is found native, and of its manufacture from artificial nitre beds, the way in which this salt is procured in every part of the continent. As this salt is imported into this country, this part of the subject is less interesting to the English manufacturer. The nitre-beds, when rich enough in this salt, are lixiviated, potash is added, and the liquor is boiled down and crystalized. All these operations are minutely described in the original work. Besides potash, sulphate of potash is occasionally employed, the salt of the nitre-beds being chiefly nitrate of lime, which is readily decomposed by the sulphate of potash; and thus an important use is made of this latter salt which is often a refuse salt of little value.

The refining of the rough Saltpetre

Appears to have undergone several important improvements in France. It was formerly crystallized twice successively, the product of the first crystallization being termed nitre of the second boiling (the rough salt being the first), and that of the next process being nitre of the third boiling, or fine saltpetre. This mode of refining required much time and fuel, and the nitre being obtained in large masses was a long time in draining, and was never quite dry or pure. During the French revolution, when every nerve was strained to supply nitre as quickly as possible, the following simple method of refining was suggested by Beaumé, and brought to perfection by Lavoisier and Carny; the rough nitre was first washed with a little cold water to remove the very soluble salts mixed with the nitre, and the remaining salt was then dissolved in boiling water, and the hot solution was poured into shallow pans and stirred all the time it was cooling, by which the nitre concreted in small crystals

of great purity that were easily drained of the adhering mother liquor. By this means a salt was procured in 24 hours, equal in purity to that which was the result of three weeks or a month's working by the old method. M. Riffaut has introduced into the royal saltpetre refineries a still further improvement. Instead of washing the rough saltpetre with cold water, it is melted in the least possible quantity of boiling water, by which most of the common salt, with which it is mixed, remains undissolved at the bottom and is removed by skimmers; the liquor is then saturated with potash, diluted with a little more water, then boiled down, and stirred whilst cooling, and the salt when drained is nitre of great purity.

Assay of the rough Salt-petre.

All the salt-petre makers are obliged to deliver in their rough salt to the government refineries (no other being allowed in France), which makes it of great importance, both for the buyer and seller, to have some easy and pretty exact mode of assaying the rough salt. This was formerly done in a very incorrect way, or rather the goodness of the article was chiefly guessed at by the general appearance, which caused frequent disputes. It is now done by washing the rough salt with a saturated solution of perfectly pure nitre, without altering the temperature, which in this case dissolves only the saline impurities of the rough salt-petre, and none of the pure nitrate of potash.

This chapter concludes with a short but clear description of the way of obtaining the potash from wood and other vegetables.

On the Charcoal.

The charcoal formerly used exclusively in French gunpowder was that of the alder-buckthorn (*Rhamnus frangula, Linn*): but the experiments of M. Lefort, in 1785, shewed that the charcoal of the poplar, lime, chesnut, and horse-chesnut, answered as well; and more lately the hazel, spindle, alder, and other soft woods have been used indiscriminately. The charcoal of the hard woods is less easily combustible. The wood is burnt in three ways, either in stacks, or in close furnaces, or in pits, and the authors prefer the latter. They have not found any particular advantage in the charcoal distilled in the English manner in iron cylinders. Charcoal extinguished in water, and used immediately, makes very good powder, but the quality of it is injured if the charcoal has been long damp. Hence the advantage of using it soon after it is burnt, or, if stacked, of keeping it as dry as possible. The wood used for charcoal

should be cut when in sap, that it may be more easily barked. M. Proust says that the charcoal of hemp-stalks is preferred in Spain, but the authors of the present work find no reason for this preference.

On the Sulphur.

There are two methods of purifying sulphur, namely, by fusion and sublimation. The former is the only method by which it can be obtained in mass, but always with much impurity. But M. Michel, a merchant of Marseilles, has succeeded in obtaining solid sulphur by sublimation, in employing a much higher heat than is generally used. The exact process is given in the original, with explanatory plates, and all the purified roll sulphur now used in France appears to be furnished in this way. This sulphur is quite pure, semi-transparent, of a lemon-yellow, leaving no sediment by fusion, and burning without any residue. All the sulphur used in the French gunpowder is derived from this manufacture.

The second part of this work gives a minute account of all the processes by which the nitre, sulphur, and charcoal are mixed and fabricated into gunpowder. The proportions of these ingredients formerly employed were 75 of nitre, $12\frac{1}{2}$ of charcoal, and $12\frac{1}{2}$ of sulphur. In 1794 a commission was appointed by the government to determine what proportions gave the strongest powder, and they found a decided superiority in strength in the following: *viz.* 76 of nitre, 14 of charcoal, and 10 of sulphur; but owing to the greater proportion of charcoal, this powder had the inconvenience of shaking into dust very soon, and not bearing carriage well, and therefore the former proportions were retained, though somewhat weaker. The proportions for sporting-powder are 78 nitre, 12 charcoal, and 10 sulphur, which being glazed, keeps its consistence very well. Mine-powder is 65 nitre, 15 charcoal, and 20 sulphur. It burns more slowly than the other kinds. It is well known that the strength of the powder depends essentially on the intimate mixture of the ingredients in the mill, and therefore the longer time it takes in grinding, the stronger is the powder. In 1793, during the immense demand for powder in France, the time of grinding was reduced to three hours, the ingredients being previously separately powdered. But the gunpowder thus hastily made would not preserve its strength when kept any length of time, and therefore now the time of grinding in the mill is fixed at fourteen hours.

We shall not extend this abstract further, as it relates merely to the manipulations, and other circumstances of high importance to the manufacturer, but of little interest to the general reader.

On the Action of coloured Rays of solar Light on a Mixture of Oxymuriatic Gas and Hydrogen. By M. SEEBECK.—*Ann. de Chim. tom.* 82.

WHEN these two gasses are mixed together, and exposed to the direct rays of the sun, a violent explosion takes place, and muriatic acid is produced. The same decomposition occurs more gradually, and without explosion, by a more moderate exposure to light. M. Seebeck has found, however, that if these gasses are confined in a blue glass over water, in strong sunshine, that the gasses are decomposed completely in less than a minute, without any explosion; and on the other hand, if a red glass is used, scarcely any apparent effect takes place in twenty minutes of strong sunshine; but if the mixture is then transferred to a colourless glass, the whole is now decomposed entirely in a few minutes, but without explosion, and the glass is filled by the absorption of the water over which it stands.

Additional Experiments on the Muriatic and Oxymuriatic Acids. By W. HENRY, M.D. F.R.S.—*Phil. Trans. for* 1812, *part* 2.

THE experiments here related are supplementary to a more extensive series on the same subject, published in the Transactions for 1800.

The general accuracy of these experiments is established by subsequent observations, but Dr. H. was induced to renew the subject on account of the important controversy between Mr. Murray and Mr. John Davy on the nature of the muriatic and oxymuriatic acids.

Dr. H. stated, in his former series, that some increase in the quantity of hydrogen, evolved by electrization of muriatic gas, was perceived when the acid gas had not been previously exposed to muriate of lime; but he now finds, that under exactly similar circumstances in other respects, no difference is produced by the drying action of muriate of lime; the effect of electrization of muriatic acid gas over mercury is a contraction of the bulk of the entire gas, the production of calomel, and the evolution of a quantity of hydrogen amounting to from $\frac{1}{16}$ to $\frac{1}{14}$ of the original volume of the acid gas. But when a certain effect has been produced by electricity, nothing is gained by continuing the process; for neither is more hydrogen evolved, nor can the contraction of bulk be carried any farther.

Dr. Henry electrified muriatic acid gas in a close vessel not

in contact with mercury. After 3000 charges from a Leyden jar no trace of water appeared, nor was any change of bulk observed. After absorbing the unchanged muriatic acid gas by water the residue was oxymuriatic gas and hydrogen, in the proportion of 100 in bulk of the former to 140 of the latter. These proportions are so far remote from equal bulks (which is usually considered as constitution of muriatic acid gas), that Dr. H. attempts to account for part of the apparent loss of oxymuriatic acid by the tarnishing of a few globules of mercury that happened to be enclosed, and by its absorption by the water used to remove the undecomposed muriatic acid. In electrizing muriatic acid gas in a vessel entirely close, no more than about $\frac{1}{70}$ of its bulk of hydrogen was obtained; whilst in the same operation, in contact with mercury, as much as $\frac{1}{14}$ was obtained. In the latter case, all the oxymuriatic gas produced was absorbed by the mercury as fast it was generated; whilst in the former it remained, of course, confined in the vessel. Hence it will appear, that when in a mixture of muriatic acid gas with oxymuriatic and hydrogen gasses, the two latter taken together equal about $\frac{1}{15}$ of the former gas, they will be brought within the sphere of mutual agency, and will reproduce muriatic acid by the continuance of the same electric power which before produced them by decomposing muriatic acid.

When muriatic acid and oxygen gasses are electrified together over mercury their bulk gradually diminishes, and the mercury becomes tarnished precisely as by the contact of oxymuriatic acid. When dry muriatic acid and oxygen gasses are introduced into an exhausted vessel and perfectly closed, so as not to be in contact with mercury or any other fluid, a portion of liquid muriatic acid condenses in drops, and if the stopcock of the vessel is opened under mercury, a portion of this fluid rushes in and is instantly tarnished exactly as by oxymuriatic acid. Hence the mutual action of oxygen and muriatic acid is the generation of water and oxymuriatic acid. The presence of the latter is also made sensible by the peculiar smell, and by destroying the colour of litmus.

Observations.—These experiments of Dr. Henry are valuable for the accuracy with which they appear to have been conducted, and the interesting changes that occur. They do not, however, go to prove the truth of either hypothesis of the constitution of muriatic acid gas. According to one opinion this acid gas contains a quantity of water as essential to its composition; and hence, when it is electrified for a considerable time, this water is decomposed, its oxygen uniting with one portion of

the acid gas to form oxymuriatic gas, and its hydrogen appearing in its proper form. According to the other hypothesis (which is Sir H. Davy's), muriatic acid gas consists of *chlorine* or oxymuriatic gas, which is a simple undecompounded body, and of hydrogen; and the operation of electricity is simply that of disuniting these elements, which then appear and act separately.

The same double explanation may be given of the result of the electrization of muriatic acid gas and oxygen. The products are liquid muriatic acid and oxymuriatic acid gas. According to one opinion, the oxygen unites with the real acid of the muriatic gas, producing oxymuriatic gas, whilst the water separated from that portion of real acid forms liquid muriatic acid with the remaining undecomposed portion: and according to the other opinion, the oxygen unites with the hydrogen part of the muriatic gas, and composes water, whilst the chlorine, the other constituent of muriatic acid gas, assumes its natural character.

An Account of some Experiments on different Combinations of Fluoric Acid. By JOHN DAVY, Esq.—*Phil. Trans. for* 1812, *part* 2.

THESE interesting experiments made with a view of illustrating the chemical history of this very curious substance are divided into four sections, of which the following is a short abstract.

Sec. 1.—*On Silicated Fluoric Acid and Subsilicated Fluoric Acid.*

Pure fluoric acid has not yet been obtained in the gasseous form, but the presence of either silex or boracic acid is necessary for this purpose. Fluoric acid gas holding silex or *silicated fluoric acid* has been known to chemists ever since the time of Scheele. The gasseous compound of fluoric and boracic acid, or *fluo-boracic acid*, has been lately discovered by Messrs. Gay-Lussac and Thenard.

Silicated fluoric acid gas is best obtained by mixing fluor-spar with finely powdered glass, in a glass retort, adding sulphuric acid, and distilling with a very gentle heat. In this way, by adding glass, the retort is saved, which otherwise becomes corroded through by a single distillation where no powdered glass is added. The gas thus obtained is perfectly saturated with silex, as it may be kept for a length of time in glass receivers without corroding them. It is heavier than common

air, in the proportion to 36.45 to 10.2, and 100 cubic inches of it weigh 110.78 grains. When this gas is added to ammoniacal gas, the silex is totally precipitated, and the two gasses condense: the silex collected by this mode of analysis is 61.4 per cent. of the weight of the silicated fluoric acid, leaving 38.6 for the fluoric acid.

When silicated fluoric acid gas comes in contact with water the acid is largely absorbed, but in so doing it parts with a large portion of the silex which it held in solution, and which precipitates in the form of a blueish spongy mass. This, when well washed and dried, is pure white silex, light and bulky. But much of the silex remains in solution in the liquid acid, and in this state the silex and mere acid (not computing the water) are in the proportion of 54.56 silex to 45.44 acid. The correct name for this liquid acid therefore is *subsilicated fluoric acid*. The utmost quantity of gas absorbed, and thus partially decomposed by water, is about 263 volumes of gas to one volume of water by direct experiment.

Liquid subsilicated fluoric acid is decomposed by the alkalies and earths. When heated by itself in a glass retort much silicated fluoric acid gas is produced, and the neck of the retort becomes lined with a gelatinous deposit of silex. Some of the liquid acid also appears to come over unaltered. When sufficient muriatic acid gas is added to the mixture of acid and gelatinous silex, that takes place on admitting water to silicated fluoric acid gas, the whole of the latter gas is reproduced, carrying up with it all the silex that had precipitated, and the liquid is simple muriatic acid. A similar effect takes place with concentrated sulphuric acid.

Boracic acid on the other hand decomposes liquid subsilicated fluoric acid in consequence of a stronger attraction for the fluoric acid itself: fluo-boracic acid is produced, and the silex is totally precipitated.

The liquid subsilicated fluoric acid appears to have no further action on silex whilst it remains in the liquid state, so that it may be kept unaltered in glass bottles. It evaporates in the air almost totally.

Sec. 2.—On the various Combinations of Fluoric Acid, Silex, and Ammonia.

The silicated fluoric acid gas and ammoniacal gas have been shewn by Gay-Lussac, to combine into a solid salt like carbonic acid gas and ammonia. This salt is therefore silicated fluat of ammonia, of which the alkali is about 24.5 per cent. of the weight. If this salt is heated in a dry vessel it sublimes unchanged, but water dissolves a portion and precipitates the ex-

cess of silex in the same manner and quantity as it does the silicated gas without the ammonia. Consequently the liquid that remains is fluat of ammonia with a smaller proportion of silex, or *subsilicated fluat of ammonia*, and must, by estimation, consist of 28.34 per cent. of ammonia. This salt has a pungent saline taste, and by slow evaporation forms transparent brilliant crystals. A further addition of ammonia separates the silex (totally according to Mr. Davy, but only partially according to M. Gay-Lussac), and if Mr. D.'s experiments are correct a simple fluat of ammonia is formed.

Fluat of ammonia is calculated by Mr. Davy to contain 76.4 per cent. of ammonia, and 23.6 fluoric acid. It is prepared, as above mentioned, by adding an excess of ammonia to the subsilicated fluat (or to the liquid subsilicated fluoric acid), separating the silex and expelling the excess of ammonia by a gentle desiccation. This salt readily deliquesces in the air. When heated a little above the degree of boiling water, it parts with a portion of its ammonia and an acid fluat is left. When the heat is stronger the salt exhales totally in excessively pungent suffocating fumes, highly disagreeable, if not dangerous to inhale. When the heat is applied in a metallic vessel no apparent change takes place in the salt, but if a glass vessel be used it is highly corroded, ammonia is expelled, and subsilicated fluat of ammonia is sublimed. The action of this neutral salt on glass is so powerful, that when a solution of it is pencilled on glass and heated, an etching is produced as easily as with the common liquid fluoric acid.

All the fixed alkalies and the earths decompose the fluat of ammonia, and form simple fluats with the alkali or earth used.

Sec. 3. On Fluo-boracic Acid Gas.

This singular compound was first discovered by Messrs. Gay-Lussac and Thenard, by heating strongly in an iron tube a mixture of fluor spar and fused boracic acid. Mr. Davy finds that it may be more easily obtained by heating gently (that is to say at a much less degree than that of boiling sulphuric acid) in a glass retort, 1 part by weight of fused boracic acid, 2 parts of fluor spar, and about 12 parts of sulphuric acid. At this heat the glass is not corroded, and the product will be pure fluo-boracic acid gas. As the boracic acid precipitates silex totally from liquid subsilicated fluoric acid, the fluo-boracic acid gas is quite free from silex. As sulphuric acid absorbs this compound gas copiously, no more of this acid should be employed than is necessary to decompose the fluor spar. If the heat be much urged, there distils over a viscid fluid composed of sulphuric and fluo-boracic acid. Mr. Davy finds the weight

of 100 cubic inches of fluo-boracic acid gas, at a medium pressure and temperature, to be 73.5 grains. Water condenses no less than 700 times its volume of this gas, forming an unctuous-looking fluid of about 1.77 specific gravity. Concentrated sulphuric acid absorbs 50 times its volume of this gas, forming a fuming tenacious compound.

Sec. 4. On the Combinations of Fluo-boracic Gas and Ammoniacal Gas.

M. Gay-Lussac finds that equal volumes of these gasses condense each other totally, forming a solid white opake salt, Mr. J. Davy also finds that, on adding to this solid salt a double portion of ammoniacal gas, the gas is entirely absorbed, and the solid salt liquifies into a transparent fluid. A third portion of ammoniacal gas may also be absorbed. A gentle heat or mere exposure to the air expels this excess of ammonia, and the salt returns to the solid form, which will volatilize in close vessels unaltered.

Observation.—Nothing needs be added to recommend to the attention of chemists these experiments on a subject possessed of equal novelty and interest. Mr. J. Davy informs us that part of his observations have been anticipated by the very elaborate and accurate researches on the same subject by Messrs. Gay-Lussac and Thenard, published in 2d volume of the *Mémoires d'Arcueil.*

On some Combinations of Phosphorus and Sulphur, and on some other Subjects of Chemical Inquiry. By Sir H. Davy. *Phil. Trans. for* 1812. *Part 2.*

In a former memoir on chlorine (or oxymuriatic acid), Sir H. Davy noticed two compounds of chlorine and phosphorus: one of them is a solid white sublimate, easily volatile, and becoming a fluid substance by union with ammonia, and is produced by heating phosphorus in chlorine gas: the other is a limpid fluid of 1.45 specific gravity, producing dense fumes in the atmosphere, and totally evaporating at a moderate heat; this is formed either by mere combustion of phosphorus in a small quantity of chlorine, or better, by passing the vapour of phosphorus through heated corrosive sublimate of mercury contained in a bent glass tube, and condensing the liquor in a cold receiver. Some further analysis of these compounds are here given. The white sublimate contains about 3 grains of

phosphorus to 20 grains of chlorine: the liquor contains twice the above proportion of chlorine.

When the white sublimate is thrown into water, it dissolves therein, producing much heat. This solution becomes a thick liquid by evaporation, which is a solution of pure phosphoric acid.

When the liquor is treated with water in the same way, it also yields a thick fluid, which crystallizes slowly by cooling, and forms transparent parallelopepidons. This singular fluid, when heated pretty strongly in the air, takes fire, emitting at the same time globules of gas that inflame at the surface of the fluid. It consists of pure phosphoreous acid and water, and is termed by Sir H. Davy *hydrophosphoreous acid*, and by being thus heated it becomes phosphoric acid. The inflammable gas which it yields by heat is not spontaneously inflammable, but explodes when mixed with common air and heated to 212°. This gas is lighter than common air, is absorbed by eight times its bulk of water, and has a fœtid smell, though less disagreeable than common phosphuretted hydrygen. It is completely decomposed by potassium heated in it, the potassium being converted into phosphuret of potassium, and the gas, now doubled in bulk, is pure hydrogen. Sulphur heated in this gas also doubles its volume, a compound of phosphorus and sulphur is formed, and the gas acquires all the properties of sulphuretted hydrogen.

From analytical experiments the author infers the composition of this peculiar phosphoric gas to be 4.5 by weight of hydrogen, and 22.5 of phosphorus. As this gas is produced by heating the liquid phosphoreous acid, and as in the process the phosphoreous is converted into the phosphoric acid, it affords a basis for calculating the oxygen required to this conversion, supposing the gas to be generated by the decomposition of water, and the oxygen of the water to be that which unites to the phosphoreus acid, whilst its hydrogen, indensed to half its natural volume, enters into the gas given out.

By the comparison of all the experiments (which agree remarkably well), phosphoreous acid is composed of 4 parts of phosphorus to 3 of oxygen, and phosphoric acid is composed of 4 parts of phosphorus to 6 of oxygen.

The peculiar gas above-mentioned differs materially from the well-known phosphuretted hydrogen given out by the action of a hot alkaline solution upon phosphorus, this latter gas being spontaneously inflammable, having much less specific gravity, and enlarging to not more than 1.5 its volume of pure hydrogen when the phosphorus is abstracted by potassium.

The next part of this Paper relates to some combinations of

sulphur, and contains some corrections of the author's former estimate of the composition of sulphuretted hydrogen and sulphureous acid. It appears that 100 cubic inches of pure sulphuretted hydrogen weigh at a mean temperature and pressure 36.5 grains, and as these contain exactly the same volume of hydrogen (weighing 2.27 grains), the difference between 36.5 and 2.25, or 34.23, will be the weight of the sulphur in 100 cubic inches. Sulphureous acid consists of equal weights of sulphur and oxygen, and sulphuric acid contains half as much more oxygen, in proportion to the sulphur, as the sulphureous acid contains.

Experiments which prove Platina, when alloyed with Gold and Silver, to be soluble in Nitric Acid. By Mr. PERCIVAL JOHNSON.—*Phil. Mag. July,* 1812.

MR. JOHNSON, who is a practical assayer, finds that though platina in a pure state is not acted on by nitric acid, yet when alloyed with gold and silver it is perfectly soluble, and with silver partially so. A hundred parts of gold being mixed with 300 of silver, and from 1 to 15 of platina, the nitric acid dissolved both the platina and silver, leaving the gold pure. Where the platina amounted to 20 per cent., $\frac{7}{12}$ths of it were dissolved, leaving the cornet flaked and black inside. The buttons have an indented crystalline and red appearance after cupellation, and rounded at the edges where there is as much as 20 per cent. of platina. By increasing the proportion of silver, more platina was dissolved by the acid. Yet it seems that platina cannot be entirely extracted by nitric acid without the concurrence of gold, for in a simple alloy of platina and silver, the successive action of dilute and concentrated acid can only remove a portion of the platina, forming a deep brown solution when saturated with this metal.

Mr. Johnson adds, that most of the Brazil gold in commerce is alloyed with palladium, often so much as sensibly to alter the colour.

Observations.—It is always useful to have practical observations confirmed by various authority; but the facts stated here are not unknown to assayers, being very particularly described by M. Tillet in his long and valuable series of papers on Assaying, in the French *Mémoires de l'Académie des Sciences*, and also by M. Vauquelin, in his excellent *Manuel de l'Essayeur*. M. Tillet particularly remarks that when the platina is not more than a tenth of the gold, and the silver is in the propor-

tion proper for *parting* (or about 3 times the gold), the nitrous acid entirely dissolves the silver and platina, and leaves the gold. He also makes the same observations with regard to the action of this acid on platina and silver as those contained in this communication of Mr. Johnson.

On the Combinations of Sulphur and Phosphorus with Platina. *By* EDMUND DAVY, *Esq. Chemical Operator in the Royal Institution.—Phil. Mag. July,* 1812.

IN all these experiments, the Platina used was the precipitate obtained from the acid solution of this metal by muriate of ammonia, washed and dried on a sand-bath, at a heat not exceeding 340°. It contained 44.5 per cent. of metal.

Supersulphuret of Platina.

The above-mentioned ammoniaco-muriate of platina was mixed with two-thirds of its weight of flowers of sulphur, and heated to low redness in a retort by a spirit lamp till gas ceased to be evolved. The volatile products were azote, muriatic acid gas, muriate of ammonia, and sulphur, and the supersulphuret of platina remained at the bottom of the vessel.

This compound has a dark iron-grey colour, soft to the touch, and leaving a streak on paper like black lead. It is infusible, and scarcely acted on by acids, except that the nitro-muriatic long boiled in it acidifies a small portion of the sulphur. Liquid potash hardly acts upon it, but dry potash fused with it partly decomposes it. When mixed with oxymuriate of potash and heated, it burns very brilliantly. When this supersulphuret is mixed with zinc filings, and strongly heated in a retort, a vivid ignition takes place, and sulphuret of zinc is formed. This supersulphuret is not decomposed at a red heat in close vessels, but in the open air the sulphur entirely escapes at this heat, and pure platina remains. In this latter mode of analysis this compound is found to consist of about 72 per cent. of platina, and 28 of sulphur.

Subsulphuret of Platina.

This substance is obtained by heating platina in contact with sulphur in an exhausted tube. Equal weights of platina and sulphur were used, a red heat was employed for ten minutes, to expel the excess of sulphur, and the subsulphuret of platina remained.

This compound appears as a blueish powder, of a metallic

lustre, and much resembles the supersulphuret in most of its properties. Analyzed in the same way as the last, it contains about 84 per cent of platina and 16 of sulphur.

Superphosphuret of Platina.

This compound was made by heating to low redness, in a small retort, ammoniaco-muriate of platina with two-thirds of its weight of phosphorus. The superphosphuret of platina remained at the bottom of the vessel after the operation.

This compound is a dark grey powder, of about 5.28 specific gravity. When heated on a thin slip of platina below redness, it becomes an ignited mass, and diminishes in bulk. On raising the heat to whiteness by a blow-pipe, it fuses down along with the platina-support.

No accurate mode of analysis occurring to the author, he was obliged to estimate the composition from the quantity of platina in the salt of this metal employed. This (supposing the compound to be simply phosphorus and platina) would give about 70 per cent. of platina and 30 of phosphorus.

A Subphosphuret of Platina

was made by heating together platina and phosphorus in an exhausted tube. At a temperature much below redness they combine with vivid ignition and flame, so that the tubes must be thick to resist the heat. This compound is also of a blueish-grey, and is obtained in small porous pieces, sometimes crystallized in cubes. When heated to redness on a slip of platina, some of the phosphorus burns off. By estimation from the platina employed, it appears to consist of about 82.5 of platina, and 17.5 of phosphorus.

Examination of a Species of Plumbago from Africa. By E. Davy, *Esq.—Phil. Mag. July*, 1812.

This substance was brought from Mozambique, and in external characters much resembled molybdena, but it was unaltered on the blow-pipe, on platina, charcoal, or borax; neither was it sensibly acted on by acids, except to yield to them a very small portion of iron. Mr. E. Davy followed Scheele's method of heating it with arsenic acid, and obtained from 7½ grains of the ore, and 30 grains of arsenic acid, after exposure to a strong red heat, nine cubical inches of carbonic acid gas, besides oxygen. In a second experiment the ore was heated with oxymuriate of potash, which also afforded much carbonic

acid, but in both experiments much of the ore remained unaltered, so that the analysis was unsatisfactory as to proportional quantities. Besides the carbon (the base of the carbonic acid) it contained some silex, with a little iron.

On some Combinations of Platina. By E. DAVY, *Esq.—Phil. Mag. Sept.* 1812.

MR. E. DAVY continues his researches on the compounds of platina, with the following results:—

Hydrosulphuret of Platina.

This substance is obtained by adding water saturated with sulphuretted hydrogen gas to a solution of platina, or by passing the gas itself through the metallic solution. In this latter way, a film of an iron-grey colour and metallic appearance forms on the surface, and a quantity of the same is also deposited at the bottom of the vessel. This substance has been considered by some eminent chemists as metallic platina, who have on that account given it as a character of this metal, to be precipitated in the reguline state by sulphuretted hydrogen. But Proust considered it as a sulphuret, which is really the case, and it has the singular property of forming sulphuric acid when drying in the air. When thus dried (and of course partly decomposed) Mr. E. Davy describes it as a black, loosely coherent powder, staining paper, and having a strong acid taste. When heated below redness, it deflagrates with red sparks, sulphureous fumes are emitted, and pure platina remains. It is soluble in nitro-muriatic acid. When heated in close vessels, the products are water, sulphureous acid gas, and a little sulphur, and a sub-sulphuret of platina remains, similar in composition to that described in the former paper.

The brown powder obtained by sulphuretted hydrogen gas and solution of platina was washed with water, and dried in a close vessel without access of oxygen, and separately examined. Mr. D. states many of its properties, by which he is led to consider it not as a true hydro-sulphuret of platina, but as a compound of sulphuretted hydrogen loosely combined with sulphuret of platina. Hence he accounts for the formation of sulphuric acid in this substance when exposed to the air, from the sulphuretted hydrogen alone being decomposed into water and sulphuric acid, and the sulphuret of platina remaining unchanged. The author attempted the analysis of this compound substance by simple distillation in close vessels, but the whole quantity employed for each experiment did not exceed ten or

twelve grains. On heating this gradually in a small retort over mercury, gas was soon given out, and a little limpid fluid condensed in the neck of the vessel. When the heat was raised to low redness, the substance in the retort became partially ignited, much gas was evolved along with a little yellow sublimate, which was sulphur. The gas was almost entirely sulphuretted hydrogen, and the substance remaining in the retort at the end of the experiment was a sulphuret of platina, containing 22 per cent. of sulphur. Mr. D. gives the following as an average result of the analysis of this hydrosulphuret, *viz.*—

	Grains.
Sulphuretted hydrogen, 12.5 cub. inches ..	5
Sulphur	4
Sulphur 18.26 / Platina 64.74 } Sulphuret of platina	83
Water	8
	100

Phosphuretted Hydrogen and Platina.

When a current of this gas is passed through a dilute muriate of platina, the gas loses its property of spontaneous inflammation. The globules are detained at the surface of the fluid, and arrange themselves somewhat in the form of a honeycomb, and a yellowish brown substance is deposited. When this substance is well washed and dried at a boiling-water heat, it takes the form of small curved laminæ, slightly acid to the taste, insoluble in acids, and when heated to redness in close vessels, it furnishes a gray semifused porous mass, having a metallic lustre, with water, and a little hydrogen gas. This gray mass exactly resembles the sub-phosphuret of platina described in the last article.

Of the Combinations of Platina with Oxygen.

The difficulty of obtaining pure oxyds of platina (the author observes) arises from the property which it has of forming triple compounds with alkalies or earths, with chlorine or muriatic acid.

Mr. Chenevix states the existence of two oxyds of platina, one of them yellow, containing 13 per cent. of oxygen; the other green, containing 7 per cent. These were obtained, according to Mr. C., by treating a solution of nitro-muriate of platina with lime water, re-dissolving the precipitate in nitric acid, evaporating to dryness, and decomposing the sub-nitrate by heat.

Mr. E. Davy, on repeating these experiments in the way above-mentioned, was not able to procure any precipitate at all.

He then attempted to obtain a simple oxyd of this metal by means of potassium. Potassium mixed with platina in a divided state was heated on a platina tray. The potassium entered into vivid ignition, and a yellow insoluble substance was formed, yielding oxygen when heated, but was found to contain alkali, though well washed with water.

The reduction of platina, by hydrogen, from its solution was then attempted.

Some hydrogen was kept for three days in contact with a solution of muriate of platina, at the end of which time the platina was precipitated in the metallic state. By calculating the quantity of hydrogen absorbed, and that of oxygen necessary to convert it into water, and taking the actual weight of the reduced platina, the oxyd of platina existing in the solution would be composed nearly of 84 per cent. of platina and 16 oxygen.

Of the Combinations of Platina with Chlorine.

The substance called by Sir H. Davy *Platinana* (the insoluble muriate of platina of other chemists) is considered by that philosopher as a simple compound of *chlorine* or oxymuriatic acid and platina. It is partially obtained by warming platina filings in oxymuriatic gas; but the best way of procuring it, according to our author, is, to boil platina in muriatic acid, adding, occasionally, a little nitric acid, to evaporate the solution to dryness, again to moisten the mass with muriatic acid, and to evaporate, and ignite nearly to redness, and then to boil the product in much distilled water, to separate any portion of the soluble compound of the same ingredients which is at the same time produced. Platinana is hardly soluble in any acid. When exposed to a red heat in close vessels, chlorine gas alone is obtained, and metallic platina remains. When it is boiled in a strong solution of pure potash or soda, a black powder is obtained, which gives out chlorine and oxygen gas by heat. Sulphur and phosphorus, when heated with platinana, decompose it: sulphuret or phosphuret of platina are formed together with the compounds of sulphur or of phosphorus with chlorine. Mr. E. Davy, on analyzing platinana by heat, obtained about 72.5 per cent. of platina, which leaves 27.5 per cent. for the quantity of chlorine.

The author continues his researches on some of the simple salts of platina, which will be noticed on a future occasion.

A New Table of the Quantities of Acid in Sulphuric Acid of different Densities; constructed for the Use of Manufacturers. *By* SAMUEL PARKE, *F. L. S.—Phil. Mag. Sept.* 1812.

MR. PARKE states, that having been often applied to by persons in the habit of using sulphuric acid for instructions respecting a mode of ascertaining the quantity of acid in diluted sulphuric acid, he invariably referred them to Mr. Kirwan's Tables, but these would not answer the manufacturer's purpose, as Mr. K. has assumed as his standard acid that which exists in dry sulphate of potash, instead of the strongest oil of vitriol actually obtainable. Mr. Parke has therefore conferred a real favour on the consumers of this acid, by constructing, from his own experiments, a table of the specific gravities of acid of every degree of dilution that can be required, shewing the proportion which each contains of common concentrated sulphuric acid, not purified by second distillation, and of the specific gravity of 1.8494 at 60°, which is as strong as it is ever sold. Mr. P. states, that the quantity of sulphuric acid consumed in this kingdom, he believes, amounts to upwards of 3000 tons annually, the greater part of which is used in a state of dilution. For the purposes of dissolving iron or zinc, it should be diluted with at least five or six times its weight of water.

Sulphuric acid is consumed in large quantities by bleachers, for making the oxymuriate of lime, and the calico-printers and dyers also use it largely, and always diluted. We refer our readers to the original for the Table, which is here given for 183 different degrees of dilution, and descends as low as 1.0068 specific gravity. More than one-third of the results are obtained from actual experiment, and the rest are supplied by interpolation.

On Sir H. Davy's late Proposal for improving the Art of bleaching Linen and Cotton Cloth, by substituting the Oxymuriate of Magnesia for the Oxymuriate of Lime. *By* JAMES OGILBY, M.D.—*Phil. Mag. Sept.* 1812.

On the same Subject. *By* MR. DONOVAN.—*Ibid.*

MR. OGILBY states, that Professor Sir H. Davy, in 1810 and 1811, delivered two courses of electro-chemical lectures at Dublin, in which, when treating of oxymuriatic acid and its

combinations, he mentioned, that the oxymuriate of lime, now generally used in the process of bleaching, could not be used with safety, as he had observed that bits of linen cloth, steeped in a strong solution of this salt, were much injured in their texture, or actually rotted.

In consequence, the Professor proposed the substitution of the oxymuriate of magnesia, as possessing equal bleaching powers; but not endangering the texture of the linen or cotton fibre.

Some difference has taken place as to the precise reason offered by Sir H. D. for rejecting the very dilute solution of oxymuriate of lime, actually employed; and some controversy has arisen on this subject, which it is not necessary to mention here, but the fact is, that this supposed noxious effect of oxymuriate of lime has been examined experimentally both by Dr. Ogilby and Mr. Donovan with great attention, and with solutions of this salt of much greater strength than any used by the manufacturer; and the results of those trials (the particulars of which are here given) are totally at variance with those given by Sir H. Davy, and shew, that linen cloth is in no respect weakened by the oxymuriate of lime, provided the acid be perfectly neutralized. It is not easy to reconcile such opposite assertions, except by supposing a difference in the state of saturation of the acid, which, probably, was the case; and of course, an excess of acid would prove equally injurious, whether the base were lime or magnesia.

With regard to the oxymuriate of magnesia, the very high price of magnesia must entirely exclude its use *generally* as a bleaching liquor for goods intended to remain white, unless some means be found of furnishing this earth at a twentieth part of its present cost.

It appears, however, from Mr. Donovan's statement that there is a real chemical reason for preferring the oxymuriate of magnesia in goods intended subsequently to receive coloured patterns in calico-printing, which is this: after the immersion of the calico, according to the usual process, in the oxymuriate of lime, the workmen are sometimes so negligent as not to wash out perfectly the oxymuriate; so that, during the subsequent souring with sulphuric acid, a sulphate of lime is precipitated into the substance of the cloth, which cannot be removed without more washing and trouble than is usually bestowed upon it. This sulphate remaining in the fibres of the cloth acts as a mordant to certain colours in the subsequent process of printing, and occasions a dulness of those parts which should be of a clear white, and probably alters and injures the fineness of many shades of colour given by the usual dying mate-

rials. These inconveniences do not attend by the use of the oxymuriate of magnesia, as the salt which this earth makes with sulphuric acid is easily dissolved out by any common degree of washing.

Mr. Donovan states, that this preference of the oxymuriate of magnesia was first claimed by the writer of the article, *Bleaching*, in the Edinburgh Encyclopædia, and that this salt had first been so employed by Mr. Ramsay, of Glasgow, about four years since the date of this communication, or in the year 1808.

Mr. Donovan adds, that the bleachers of Scotland continued to be as much satisfied with the use of oxymuriate of lime as the Irish bleachers had been.

We are not informed by Mr. Donovan of the precise mode in which the oxymuriate of magnesia is prepared by those of the Scotch printers, who are represented as using it very extensively, but probably some cheaper mode of obtaining the earthy basis is adopted, than that of first preparing the carbonate of magnesia, as it is met with in the shops.

An Attempt to analyze Cast Iron. By PROFESSOR BERZELIUS. *(From the Stockholm Transactions). Phil. Mag. October*, 1812.

THIS eminently skilful chemist observes, that the chief difference between cast iron and steel, has long been supposed to depend on the presence of a small proportion of oxygen in the cast iron, so that this would be a sort of carburetted oxydulum of iron, whilst steel would be a carburetted metallic iron.

After giving several valid objections against the probability of this supposition, he proceeds to shew the necessity of a full analysis of cast iron, and to supply this great desideratum (for such it really is) he relates, in great detail, the analysis of a specimen of good Swedish cast iron holding manganese, of which analysis the following are some of the most important particulars.

One of the greatest obstacles that occurs in the analysis of cast iron is to ascertain the quantity of carbon it contains. When the iron is dissolved in an acid, the carbon, in the moment of parting with the iron, enters into new combinations, partly with the gas generated, partly with the acid, and partly also with the iron. When the cast iron is dissolved in sulphuric acid there is disengaged, as every one knows, a fœtid inflammable gas, consisting of carburetted hydrogen gas, containing a portion of a fœtid volatile oil, which latter substance is gene-

rated from the carbon by the action of the decomposed water and deposited in the conducting glass tubes in the form of a grey, tough, iridiscent pellicle. But part of this oil also enters into the acid solution, and another part remains behind in the black, insoluble, carbonaceous residue, and may be afterwards extracted by alcohol. When the iron is phosphuretted, it produces a still more fœtid oil, and phosphorus is found in the oily black residue.

When muriatic acid is used as the solvent of the iron, more gas and less oil are obtained; and hence the insoluble residue is less black, and contains a greater proportion of silex.

The author employed nitro-muriatic acid for the analysis, and during its action upon the iron the gas was passed through lime water, from which it copiously precipitated carbonate of lime—a proof that part of the carbon was acidified by the acid. During the solution bright particles of graphite separated, which were afterwards dissolved by raising the heat and using a stronger acid.

After the action of nitric or nitro-muriatic acid on the cast iron was completed, there remained a blackish, soft, carbonaceous mass, amounting, on an average, to 4 per cent. of the iron employed. This mass was always partly soluble in water, and the solution resembled that of the extractive matter found in decayed vegetable mould. Sometimes boiling water dissolved it so copiously, that much was again separated by cooling. Caustic ammonia also readily dissolved it, as did caustic potash into an opake dark fluid, which acids rendered turbid. When the aqueous solution of this extractive matter is evaporated to dryness and ignited, it smells like burnt turf, and remains long ignited, and finally, leaves a greyish red ash. The author suggests that the generation of this singular extractive matter may be analogous to Hatchett's artificial tannin, produced by the action of nitric acid and charcoal. As part of this extract also accompanies the iron in its solution, it shews the extreme difficulty of ascertaining with accuracy the proportion of carbon in cast iron. When the extractive matter was digested with muriatic acid, and the earthy residue ignited, some magnesia always remained in the residue, notwithstanding the previous action of the muriatic acid. This, the author observes, is analogous to what occurs in vegetables, from which the various earths, met with in the ashes, can never be separated by acids before combustion.

When a mixture of sulphuric and nitric acids was employed to analyze the cast iron, and the solution was saturated carefully with ammonia, a pale yellow precipitate slowly fell down, which the author took to be a mixture of phosphate of iron and silex. But on burning, it emitted vapours of sulphurous acid,

and left a red oxyd of iron, which completely dissolved in muriatic acid, and therefore contained no silex, and the muriatic solution remained long mixed with a solution of muriated lead without any deposit of phosphate of lead, and therefore contained no phosphoric acid. This precipitate, therefore, was a sub-sulphate of oxyd of iron. The water employed to wash this precipitate deposited, on standing 48 hours, a large sweetish colourless salt, resembling alum; but on further examination was found to be a triple salt of sulphuric acid, ammonia, and oxyd of iron.

Professor Berzelius gives the following useful remarks relative to the very difficult point in analytical chemistry, of the separation of iron and manganese from any acid which contains both these metals in solution. It is now well ascertained that the succinic acid will, when properly managed, precipitate the iron totally, and leave the whole of the manganese; but this acid is unfortunately too expensive where most of the metal is iron.

Mr. Hisinger has shewn that the *benzoic acid* perfectly resembles the succinic in this property (as will be mentioned in the following article), but it is to be remarked, that when most of the neutral benzoats are evaporated, a portion of the acid flies off, leaving the remaining salt with excess of base, which excess will also precipitate manganese, and thus vitiate the result. But, fortunately, the benzoat of ammonia is an exception, for this salt, when evaporated, becomes rather acid than alkaline, and this, therefore, is the salt to be preferred in analysis.

Another remark is introduced relative to the separation of manganese from magnesia, which is also a matter of considerable difficulty. After noticing the various methods in use, he gives the following as the best; viz. to calcine the mixed carbonates of magnesia and manganese, to expel the carbonic acid, to treat the residue in dilute sulphuric acid, which will dissolve the magnesia and part only of the manganese, and then to separate the latter by prussiat of potash, which will leave all the magnesia in the solution, and separate only the manganese; after which the magnesia may be recovered by caustic potash. As the white oxyd of manganese becomes brown by ignition it is a proof that the magnesia contains none of this metallic oxyd when it remains white after being heated red hot.

The author also adds, in a note, that M. Gay-Lussac has since found, that most of the metals are precipitated from their neutral solutions, in acetic acid, by means of a stream of sulphuretted hydrogen, which may therefore be well employed in separating oxyd of manganese from magnesia. Vauquelin also states that hydrosulphuret of potash will answer the same purpose, the manganese being entirely thrown down in the form of a hydrosulphuret.

To prove that this cast iron contained neither sulphur nor phosphorus, it was dissolved in pure nitric acid, the solution was exactly saturated with caustic ammonia, and divided into two portions, one of which was mixed with muriate of barytes, and the other with acetite of lead. As neither of them produced any precipitate, the former shewed the absence of sulphuric acid, and the latter of phosphoric acid, and also of sulphuric. To shew that no chrome was contained, the iron fully oxidated with nitric acid was healed with potash in a platina crucible. The solution in water was at first slightly green owing to a little manganese remaining, but which soon precipitated. Nitrated sub-oxyd of mercury added gave only a little colourless precipitate, owing to the presence of an atom of muriatic acid.

Many particulars of the analysis are added which we do not introduce in this place, our object being chiefly to draw the readers attention to this valuable paper, which shews in a peculiar manner the great difficulties that occur in the analysis of iron ores and its products, and the resources that the skilful chemist has to overcome them and arrive at a tolerable accuracy of result.

Researches respecting the Action of the Benzoates on the earthly and metallic Salts. By W. HISINGER.—*(From the Stockholm Transactions).—Phil. Mag. Oct.* 1812.

PROFESSOR BERZELIUS having suggested that the *benzoates*, like the succinates, might be employed for separating iron from manganese when dissolved in acids, M. Hisinger has here undertaken a fuller examination of this subject with the following valuable results:—

The benzoic salt used was the benzoate of ammonia prepared from pure white sublimed benzoic acid. The effect of this was first tried on various solutions of the earths, all of which were first perfectly saturated with ammonia and diluted.

The salts of barytes, strontian, and magnesia, gave no precipitate whatever with the benzoate of ammonia. The salts of yttria and lime gave a white precipitate again soluble on further dilution. In a solution of alum, saturated with ammonia, the benzoate had a similar effect.

The benzoate of ammonia was then added to a variety of metallic solutions, with none of which it produced any permanent precipitate, except in the following cases:—

Muriate of tin gives a white precipitate, which dissolves slowly and only when a small quantity of the benzoate is added.

Muriate of Tellurium gives a white precipitate almost insoluble.

Nitrate of mercury gives a white crystaline insoluble precipitate.

Muriate of iron gives an orange insoluble precipitate.

The Benzoate of iron was further examined in the following way.

One gramme of pure brown-red oxyd of iron, previously heated to redness, was dissolved in muriatic acid with the assistance of gentle heat. The solution was diluted and then accurately neutralized with ammonia, and then benzoate of ammonia was added as long as any deposit was produced, The precipitate was bulky when wet, and of a pale reddish yellow colour. It was carefully edulcorated on a filter, and dried by standing several days on a stove till it ceased to lose weight. The colour became a little paler when dry. It then weighed 4 grammes, or exactly four times the weight of the red oxyd of iron employed. Hence the benzoate of iron dried at a gentle heat in the air, contains 25 per cent. of red oxyd of iron. The solution from which the precipitate had been collected was examined by the nicest tests, and was found to contain no appreciable portion of iron.

This benzoate of iron, when long digested with warm water, is partly dissolved and decomposed, and more rapidly so in boiling water, and hence care should be taken not to use boiling water in the edulcoration of this salt.

Benzoate of iron dissolves in moderately strong muriatic acid, and hence it is still more necessary to make the solution of iron perfectly neutral before the benzoic test is applied to separate this metal from its solution in muriatic acid.

Benzoate of iron kept for some hours in liquid ammonia at a gentle heat is totally decomposed; benzoate of ammonia, free from iron, remains in solution, and the whole of the oxyd of iron precipitates.

The following experiments were made to try the power of benzoate of ammonia, to separate iron from earths and other metals, when together in solution.

A known quantity of red oxyd of iron was dissolved in muriatic acid, and was mixed with a solution of alumine in sulphuric acid, and accurately neutralized with ammonia. Benzoate of ammonia was then added, till the solution did not change tincture of galls. The benzoate of iron, collected and ignited, gave exactly the same quantity of red oxyd of iron as that first employed, and hence the iron was accurately separated from the alumine.

A mixed solution, of the oxyds of iron and nickel, was then tried in the same manner, and the iron alone was separated, leaving the nickel in solution.

The same occurred with a mixed solution of the oxyds of iron and cobalt.

The same also took place with a solution of the oxyds of iron and manganese.

The only apparent inaccuracy in these experiments is derived from a very minute proportion of benzoate of iron, which is retained by the mere water of the mixed solution, and gives some very slight traces of iron when the solution, remaining after the separation of the precipitated benzoate of iron, is evaporated to dryness. But this is so small an inaccuracy, as not to deserve notice for any practical purpose.

Mr. Hisinger adds, that this method proposed by Berzelius of separating iron and manganese, by means of benzoate of ammonia, not only perfectly answers this purpose but also affords a hitherto unknown agent for the purification of nickel, cobalt, and most of the metals and earths from iron, with the sole precaution of perfectly neutralizing and diluting the solutions, and at the same time bringing the iron to the highest degree of oxygenation. It should, however, be added, that after having thus separated the iron from any mixed solution by means of the benzoate, the excess of this latter salt should be destroyed by boiling the solution with some stronger acid, to obviate any confusion that might be caused by the benzoic acid on the subsequent part of the analysis.

Memoir on the Properties of oxygenated Muriatic Acid, being a Sequel to that already published on the same Subject. By F. R. CURAUDAU.—*Journ de Phys. for August*, 1811.

IN the former memoir, M. Curaudau maintained the hypothesis that oxymuriatic acid contained no oxygen, and that it differed from muriatic acid in containing no hydrogen, or in other words, that muriatic acid, when deprived of hydrogen, becomes oxymuriatic acid. The author also maintains, contrary to the opinion of Messrs. Gay-Lussac and Thenard, and many other chemists, that muriatic acid does not necessarily contain any water in its composition. The chief argument which he brings for this opinion is, that the water of composition of every substance that it contains is decomposed and expelled by distillation with charcoal at a strong heat, even where the same heat alone, without the mixture of charcoal, fails to produce any effect. But when dry muriatic acid gas is passed through an ignited tube containing charcoal it is in no degree altered, and hence it can contain no water of composition.

M. Curaudau gives the following experiments in this memoir, to shew the composition of muriatic acid as condensed in fused muriate of silver.

1. A known weight of silver was dissolved in nitric acid; this was precipitated by muriatic acid, and the muriate of silver, after due washing, was fused in a phial, the weight of which, when empty, had been previously taken. The increase of weight in the phial was that of the dry muriate of silver, and as the quantity of silver itself was also known, that of the muriatic radical combined with it was equally determined. From this he concludes that 100 parts of fused muriate of silver contains 75.56 of silver and 24.44 of muriatic radical.

2. A weighed phial was filled with a solution of nitrate of silver with excess of acid, and saturated with nitrous gas. Oxymuriatic gas, dried over lime, was passed in, and by means which we need not describe, the weight of the oxymuriatic gas absorbed by the solution of silver was exactly taken. The resulting muriate of silver was collected and fused in a weighed phial as before. After deducting the weight of the silver from the muriate (estimated at 75.56 per cent. from the data furnished by the former experiment), the remainder of the weight of the muriate was exactly the same as that of the dry oxymuriatic gas absorbed by the solution.

3. The last experiment was repeated in every particular, except that muriatic acid gas (expelled from salt and sulphuric acid, and dried by muriate of lime) was substituted to the oxymuriatic gas. The weight of the resulting muriate of silver was now *less* than that of the estimated quantity of silver added to that of the muriatic acid absorbed; and as the proportion of silver was not likely to vary, the author infers that the loss was sustained by the muriatic acid gas, and it amounted to about $\frac{1}{3\frac{1}{5}}$ of its weight.

The author infers from these experiments, first, that fused muriate of silver consists of metallic silver and dry oxymuriatic acid; and hence, when oxymuriatic acid combines with the solution of any *oxyds* of silver (such as the nitrate), the oxygen which is always evolved is derived from the metallic oxyd, and not from the oxymuriatic acid.

The second inference is, that muriatic acid consists of hydrogen united with oxymuriatic acid, and hence, when muriatic acid combines with the same metallic solution, the hydrogen of this acid forms water with the oxygen of the metal (which accounts for the loss of weight in the muriatic acid, and the non-appearance of oxygen gas), and the compound is, as before, the metal combined merely with oxymuriatic acid.

We may add, that this opinion of M. Curaudau is in this re-

spect the same with Sir H. Davy; and in a subsequent letter to the Editor of the Journal de Physique, M. Curaudau claims the priority of discovery in this point over the English chemist.

Experiments on the Sugar of Milk. By Messrs. BOUILLON-LAGRANGE, *and* VOGEL.—*Journ. de Phys. for March*, 1811.

THE authors of this Memoir, after giving a slight history of some of the experiments that have been made by other chemists, notice, that Parmentier and Deyeux, in their new researches on this subject, assert that sugar of milk is only a combination of the saccholactic acid with sugar, and that it is owing to the presence of this acid that the taste and solubility of the sugar are so much kept down and impaired. They also assert that a substance exactly resembling sugar of milk may be artificially formed by boiling together saccholactic acid and sugar. This experiment, however, did not succeed with Messrs. B. and V. the authors of the present Memoir, as they could only produce a mingled mass, the contents of which were easily separable by alcohol, which dissolved out the sugar and left the saccholactic acid untouched.

The principal experiments on sugar of milk here related are the following:—

Sugar of milk carefully heated, melts, puffs up, and when it has been some time in fusion, may be drawn out into thread like burnt sugar, which it also resembles in smell. If thrown on a hot iron, it burns rapidly, with a bright flame, and leaves more charcoal than sugar does. By dry distillation, it yields acetic acid, with oil, and much carbonic and carburetted hydrogen gas.

Sugar of milk is soluble in five parts of cold water and twice its weight of boiling water. The saturated hot solution deposits part of its contents on cooling in the form of four-sided prisms.

If a hot solution of sugar of milk is boiled with nitric acid, and evaporated, carbonic acid and nitrous gas are disengaged, and the mixture forms a thick syrup, which is soluble in boiling alcohol though the sugar of milk itself is not. The hot solution deposits, on cooling, a white powder, which is mucous acid. If the nitric acid is very weak, only a sugary mass is obtained, soluble in alcohol, which, however, will not ferment with leaven, and is, therefore, not identical with common sugar.

Muriatic acid, when cold, merely dissolves sugar of milk;

but when heated, after long digestion, some charcoal is separated. Muriatic gas, kept for some days in contact with sugar of milk, changes it to a grey powder, effervescing with sulphuric acid but not itself sour to the taste. In its habitude with muriatic acid gas, sugar of milk differs from the cane-sugar, for the latter immediately is blackened by the acid gas and changes to a carbonaceous powder, soluble in water, which solution is not sweet to the taste, but when concentrated by heat is sour and very bitter.

Oxymuriatic acid appears to act nearly in the same way on sugar of milk, cane sugar, starch, and gum arabic. When long kept in contact with it, they grow brown, and give out some carbonic acid, after which the peculiar action nearly ceases.

Distilled vinegar dissolves sugar of milk easily, and by evaporation crystals are readily formed, in which circumstance it differs from cane sugar, which does not crystallize from its acetic solution.

Caustic potash, sugar of milk, and a little water, effervesce strongly, and grow very hot, and turn to a brown liquid, which is only partially soluble in alcohol. If the solution of sugar of milk, in liquid potash, be distilled with an excess of sulphuric acid, some vinegar condenses in the receiver. The matter which gives the colour to the solution of sugar of milk in potash, examined by various chemical means, is found to be nearly the same as *vegetable extract.*

Neither alcohol nor ether dissolve sugar of milk. If highly rectified alcohol be added to half or a third of its bulk of a saturated watery solution of sugar of milk, the greater part of the latter separates in small crystals in about ten minutes time.

Many experiments were made, by the authors of this memoir, to excite fermentation in sugar of milk by the assistance of leaven, but without success. Neither could entire cow's milk, nor its whey, be brought into true vinous fermentation, so as to produce alcohol by subsequent distillation.

The authors conclude by enumerating the characters by which sugar of milk differs from cane sugar.

Extract of a Letter from M. BUCHOLZ *on the Fermentation of Sugar of Milk.—Journ. de Phys. Dec.* 1811.

M. BUCHOLZ having asserted, in a note to his edition of *Gren's Chemistry*, that sugar of milk was fermentable, he here mentions that this was founded on the authority of Trommsdorf, and not on his own experiments. M. Bucholz has since made

the trial, after seeing the contrary asserted in the memoir of Messrs. Bouillon-Lagrange and Vogel, and fully confirms the observation of these chemists, viz. that sugar of milk is not susceptible of the spirituous fermentation. Two ounces of this substance were mixed with 30 ounces of water and 3 spoonfuls of beer yeast, and kept in a warm place for 10 days. A little gas was given out, obviously only from the yeast itself, and on distillation only a slightly sourish liquor was obtained, which did not yield any alcohol.

Memoir on the Extraction of Sugar from Beet Root, in the great way, with some considerations on the Cultivation of that Plant. By M. BARRUEL, *Director of Chemical Operations to the Faculty of Medicine at Paris, and by* MAXIMIN ISNARD.—*Journ. de Phys. for May,* 1811.

OF all substitutes for cane sugar, which the impediments to colonial trade on the continent of Europe have brought into notice, none seems to promise such a degree of success (all circumstances considered) as the extraction of sugar from the root of the white beet.

M. Achard, of Berlin, appears to have been the first who undertook, in a large way, several years ago, the experiment of cultivating the beet and extracting its sugar; in which he was assisted by the Prussian Government. His labours were so far successful, that a practicable process of extracting the sugar was ascertained, and many valuable facts on the subject were brought to light; and in particular, it appears that the beet will yield a perfectly good sugar, capable of being refined very highly, and which will supply the place of the cane sugar for all useful purposes. M. Achard, however, was not able to bring the expense within a proper compass, so as at all to rival the West India sugar in the market, even when loaded with heavy duties: but the perseverance of the French Emperor in his plan of lessening the value of the colonies, by adopting substitutes for their staple commodities, has caused a repetition of M. Achard's experiments by Deyeux (a very excellent practical chemist), who was assisted by M. Barruel; and, as it is stated in the preliminary observations to this memoir, they succeeded in producing two loaves of perfectly white hard fine sugar, equal to the finest procured from the cane muscovado.

These trials have been again repeated on a considerable quantity of materials by M. Basruel, the report on which is published by authority in Paris, and is given in this Journal.

The various operations required for the extraction of the

sugar from the beet root are so very similar to those which we have described in a former number as performed on grape juice, that we shall do little more than enumerate them.

1*st Process. To wash the roots and cut off the tops.*

2. *To reduce the root to a pulp.* This may be done in various ways. The authors prefer an apparatus of two indented cylinders, one working within the other.

3. *To express the juice.* This should be done as speedily as possible, for the juice alters very rapidly, and becomes constantly more and more mucilaginous, to the injury of the future operations. 100 parts of beet give from 65 to 70 of juice.

4. *To neutralize the acid and evaporate.* When the juice begins to boil, some chalk is stirred in as long as there is any effervescence. It is then scummed, boiled down sufficiently, and the syrup transferred to conical moulds for six or seven days to deposit its earthy salts.

5. *To clarify and boil down.* The syrup is clarified either with skimmed milk or blood, and then strained and boiled down.

6. *To crystallize the sugar.* This is the longest process. It is done in square shallow earthen or tinned iron vessels kept in a stoved chamber, the heat of which is steadily maintained at 90° to 95° Fahr. The sugar does not begin to crystallize in less than six or seven days. The crystals form a crust at the top of the liquor and the sides of the vessels, which continue to form as long as the liquor retains any sugary taste. In about 25 or 30 days the crystallization ceases, and the fluid which remains has a saline and unpleasant flavour. The crystallized crusts are collected and cautiously pressed in a sack, and then yield the first rough muscovado, which is stoved for ten or twelve hours, and is fit for the common uses of muscocane sugar.

By these processes the authors have obtained 74 kilogrammes of muscovado from 5000 kilogrammes of beet root. *(The kilogramme is equal to about* 35¼ *oz. averdupoise, or* 2.205 *lbs.)* The muscovado is then fit for further refining, by claying, &c. in the usual manner, in which it loses about ⅛ of its weight to be reduced to saleable loaf sugar.

Some observations are added on the cultivation of the beet. It requires a light dry sandy soil. The seeds are sown in April or May, and the plants require much weeding and thinning. When they have acquired their full size, which is from October to November, the tops are headed off and serve as fodder for cattle; and the earth is turned down from round the top of the root to give access to the sun, which improves the quality of the juice. The root is then dug up, and left for a few days on the surface before it is stored. It should be kept in a dry place.

One *arpent* of ground should produce at least 15000 kilogrammes of roots.

The authors add their calculations of the expense of cultivating the beet and manufacturing sugar in the great way, partly founded on the actual cost of their experiment on 5000 kilogrammes; and partly an estimate (from what data does not appear) of the first cost of buildings, machinery, labour, rent of land, &c. &c. The result of the whole is, that for cultivation of the beet and manufacture of the sugar every kilogramme of muscovado will cost the proprietor 98 centimes (100 *centimes make a franc*), and every kilogramme of refined sugar will cost one franc 40 centimes.

Observations.—There seems good reason to believe, that the process of manufacture is given fairly and correctly, as far as the production of the muscovado is concerned, but nothing is said as to the mode of its subsequent refinement. The term *refined sugar* is a very indefinite one, but if it has at all the same meaning in France as in this country, we apprehend that the proportional quantity of refined, said in this Memoir to be obtained from the muscovado, must be excessively over rated, as much as the expense of refining is probably under valued.

The following conclusion of this Memoir shews, that M. Barruel knows the way to make his labours acceptable at St. Cloud.

"The manufacture of beet sugar is also important as a point of political economy, as tending to free us from a tax of more than 40 millions (of livres) which we pay to our enemy for this commodity. If, as we have seen from our experiments, one *arpent* of ground will produce 222 kilogrammes of sugar, then it will only require 67,567 *arpents*, or less than 15 square leagues, to produce 15 millions of kilogrammes of sugar, which may be reckoned to be equal to the annual consumption of this article in France. Now what are fifteen square leagues to the whole territory of France, which contains more than thirty thousand?

"Further, if, following the example of the great empire, all Germany, Italy, and even Russia, should take to this manufacture, what a blow would be struck against that nation which is so proud of its colonies and its monopoly! The blow may be long in coming, but will not be less terrible; a single look of encouragement from the greatest of monarchs may hasten it sooner than one is aware of!"

On the Production of Sugar from Starch. By M. KIRCHOFF, *of St. Petersburg.—Journ. de Physique, March,* 1812.

M. KIRCHOFF, of St. Petersburg, has just published a new method of obtaining sugar from starch, by means of sulphuric acid. The trial has been made in the large way by order of the Russian Emperor.

The process is as follows: Take 100lbs of starch, 400lbs of water, 1lb of sulphuric acid, and sufficient powdered charcoal and chalk. First mix half the water with the sulphuric acid, and boil it in a well tinned copper; rub the starch with the rest of the water; pass it through a sieve, and add it, by six ounces at a time, to the boiling dilute sulphuric acid. When the whole is added, continue the boiling for thirty-six hours, adding more water in the room of that which is boiled away; then add some charcoal powder, and chalk sufficient to saturate the acid, and pass the liquor through a linen cloth, which is now clear and sweet. Evaporate it by a gentle heat to the consistence of syrup, when the sulphate of lime will crystallize. Again strain the liquor, and set it by to crystallize, when the sugar will separate in about three days. Press the rough sugar with care so as to free it from the syrup, and by re-dissolving and again crystallizing the raw sugar, it will become very fine and good.

M. Kirchoff observes, that sulphuric acid, in any proportion, will convert starch into sugar, but if the quantity of acid is increased, more water must be added, and especially the boiling should be continued longer, which in every case remarkably promotes the subsequent crystallization. The nitric, muriatic, and oxalic acids, will equally convert starch into sugar, but not the acetous, phosphoric, or tartareous acids.

Memoir on the Liquid Sugar of Starch, and on the conversion of insipid vegetable matter into fermentable Sugar. By M. VOGEL, *Ann. de Chim. tom.* 82. *Extracted by* M. BOUILLON LA GRANGE.

The remarkable experiments of M. Kirchoff, mentioned in the foregoing article, have been repeated by M. Vogel with much care and attention. M. Vogel's first experiments were nearly the same as those of M. Kirchoff, and with the same results, except an increase in the product of sugar, by doubling the dose of sulphuric acid. In the following experiments the process was repeated more at length, and is thus described:—Some starch was first well washed with cold water, to remove any accidental saccharine or extractive matter, and well dried. Two kilogrammes of this starch, rubbed down with eight kilo-

grammes of river water, acidulated with 40 grammes of concentrated sulphuric acid, were boiled for thirty-six hours in a silver bason. For the first hour, the mixture was stirred constantly to keep it from burning, but afterwards, as it became thinner, only occasionally. Water was, from time to time, added, to supply the waste by boiling. After the boiling, the whole was clarified with charcoal and chalk (the precise mode is not here mentioned), and filtered through a woollen cloth. The liquor was then evaporated nearly to a syrup, and let to cool, to allow some sulphate of lime to settle; after which the clear syrup was boiled down to a thick consistence. This syrup is much clearer and sweeter when prepared in a silver vessel than in one of tinned copper; indeed, this latter material can hardly be used on account of the action of the acid upon the tin by the long boiling; but a leaden boiler may be employed with advantage. The quantity of rich syrup given in this process is about equal to that of the starch employed; and M. Vogel obtained the same results with twice the proportion of acid, and only eight hours boiling.

As several vegetable substances have a decidedly sweet taste but without containing any real sugar that can be extracted from them, M. Vogel tried to produce the vinous fermentation in the starch sugar. A quantity of it was mixed with warm water and leaven, the fermentation soon took place, much carbonic acid was given out, and the fermented liquor gave, by distillation, a sensible quantity of alcohol.

The most highly saccharine starch-syrup, slowly stoved in tin plate moulds, gave a perfectly transparent elastic matter, like the paste of jujubes, which attracted moisture from the air.

A similar saccharine gummy mass was obtained from potatoe starch. This mass was further analyzed by boiling with alcohol, which left undissolved about a fifth of the whole, as a very viscous matter, that became friable when dry, and again dissolved by cold water into a thick mucilage insoluble in alcohol. In these properties it closely resembled gum-arabic, but differred from this gum in not forming the mucous acid when treated with nitric acid.

The gummy matter of the starch syrup has been considered by some as a compound of starch, water, and sulphuric acid, but M. Vogel shews very clearly, that it does not contain any of this acid, neither, indeed, does the saccharine part, soluble in alcohol, give any indications of sulphuric acid.

These experiments led the author to examine the action of the diluted mineral acids upon other substances. Sugar of milk was selected, as being in its natural state incapable of entering into the vinous fermentation. One hundred grammes of sugar of milk were boiled for three hours with 400 grammes of water

and 2 grammes of strong sulphuric acid, adding water to supply the waste. The excess of acid was then neutralized by chalk, and the liquor when strained was clear, but slightly coloured. Slowly evaporated, it left a think brown syrup, which in a few days thickened to a crystalline mass of a very rich sweet taste, much more so than the sugar of milk itself, and soluble in alcohol, in which too it differs from sugar of milk. This crystalline mass very readily entered into fermentation when properly diluted, and the fermented liquor yielded a considerable proportion of alcohol. The experiment was repeated with 3, 4, and 5 parts of sulphuric acid, and with equal success, the crystalline mass being always highly saccharine and fermentable.

Muriatic acid was found to have the same effect with the sulphuric in changing the sugar of milk into an extremely rich, sweet, fermentable syrup.

Nitric acid, on the other hand, and radical vinegar, produced no such change.

Such are the facts of this singular conversion of starch or sugar of milk into an intensely sweet fermentable saccharine mass, though it does not appear that perfect crystallized sugar has yet been obtained in this way. The theory of this operation is very difficult of explanation. Some have thought that the mere continuance of heat effected the change; but the author boiled starch and water alone for four successive days, and at the end a very liquid mass was obtained, which, when slowly dried, left a thick bitter mucilage without the smallest saccharine taste.

It becomes a question whether the sulphuric acid is decomposed in the process. For this purpose M. La Grange took a given weight of sugar of milk, and sulphuric acid and water, boiled them for three hours in a retort, and the distilled liquor was carefully examined by barytes, litmus, and other tests, but neither sulphuric acid, sulphureous, acetic, nor carbonic acid was produced, the liquor being pure water. Afterwards on saturating the acid contents of the retort with a known weight of potash, and evaporating the whole to dryness, the dry mass was less, by about an eighth part, than the united weights of the sugar of milk and the sulphate of potash produced by the sulphuric acid and the alkali employed. This loss of weight must therefore be accounted for in the water distilled over, as no gas whatever was generated in the process.

Hence, La Grange supposes, that the operation of the sulphuric acid is to disengage from the starch or sugar of milk so much as hydrogen and oxygen as will produce water, and that the loss of these principles converts the remainder into a saccharine matter.

On *the Sugar from Potatoe Starch.* By DR. TUTHILL.—*Phil. Journ. vol.* 33.

A VERY interesting experiment on this subject is related by Dr. T. One pound and a half of potatoe starch was mixed with six pints of distilled water, and a quarter of an ounce, by weight, of common sulphuric acid, in a common covered earthen vessel. The mixture was kept boiling for thirty-four hours without intermission, fresh water being occasionally added to supply the waste by evaporation. At the end of twenty-four hours the liquid had become sensibly saccharine, and this quality continued to increase as the boiling was prolonged. At the end of thirty-four hours half an ounce of finely powdered charcoal was added, and the boiling continued two hours longer. The acid was then saturated by lime, and the boiling continued for another half hour, after which the liquid was strained through calico, and the residue in the filter washed with warm water. This residue, when dry weighed $\frac{7}{8}$ of an ounce, and was charcoal and sulphate of lime. The clear liquor was then evaporated in a water-bath to the consistence of syrup, and set aside to crystallize. In eight days it congealed into a crystalline mass, tasting like common brown sugar with treacle. One pound of this sugary matter was then re-dissolved in four pounds of water, a quarter of an ounce of yeast added and the mixture set to ferment. In ten days the fermented liquor began to smell sourish, and was immediately distilled. A pint and a half of the first runnings were alone collected, which, re-distilled, gave a weak ardent spirit, which, from its specific gravity, was found, by Blagden's tables, to contain 14 drams by measure of proof spirit.

The whole quantities used, and the products were:—$8\frac{1}{2}$ lbs. of potatoes, yielding $1\frac{1}{2}$ lb of starch, which gave $1\frac{1}{4}$lb of dry saccharine matter, from which, after fermentation, as much ardent spirit was extracted as would equal 14 drams by measure of proof spirit.

Observations on the three preceding Articles.—M. Kirchoff's curious discovery of the conversion of starch into sugar, by the agency of sulphuric acid, is fully confirmed by these experiments, but the explanation of this singular change is very obscure. By a late analysis of several kinds of vegetable matter, through the agency of oxymuriate of potash, by Messrs. Gay-Lussac and Thenard, these eminent chemists think that they have established the following facts, viz.

1. That a vegetable substance is always acid when the oxy-

gen which it contains is in a greater proportien to the hydrogen than that which constitutes water.

2. That the vegetable substance is always resinous or oily, or alcoholic, when the oxygen is in a less proportion to the hydrogen than to constitute water.

3. That the vegetable substance is analogous to sugar, starch, gum, ligneous fibre, &c. when all the oxygen and hydrogen united would exactly compose water.

If there is any reliance to be placed on these positions, it must follow that sugar, starch, gum, and sugar of milk, may be said to consist only of carbon and water; and on a separate analysis of each, the above chemists estimate the carbon of sugar to be 42.47 per cent.; that of gum arabic to be 42.23; that of starch to be 43.35; and that of sugar of milk to be 38.825; all the remaining part of each substance to be oxygen and hydrogen, in the same proportion as would produce water. Therefore, if the agency of sulphuric acid in M. Kirkhoff's experiment is merely to abstract water, or its constituent parts, from the starch or sugar of milk, and thus to convert them into sugar, it should of course follow that sugar must contain proportionally much more carbon than these. This explanation would answer well enough for sugar of milk, the carbon of which, according to the statement given, is only 38.825 per cent.; but the carbon of starch is somewhat *more* than that of sugar, and that of gum arabic is scarcely less. It appears certain, however, that some loss of weight is experienced by these substances during their conversion into sugar, and that there is no evidence of any decomposition of the sulphuric acid.

Analysis of Horse's Chyle. By M. VAUQUELIN. *Ann. Chim, tom.* 81.

CHYLE coagulates spontaneously, as blood does, and the portion left in a liquid state by this coagulation is further coagulated by heat, by acids, and by alcohol. When the alcohol is boiling, it also retains in solution a substance which is partially deposited in flocculi on cooling, and the remaining liquor becomes milky on the additiou of water. The author considers it as a kind of fatty matter, like that obtained from brain. Part of this substance also accompanies the albumen of chyle after coagulation by heat, and renders it opake. The coagulum, formed spontaneously, has a very close resemblance to the fibrine of blood; for when washed it becomes a fibrous elastic substance, soluble in caustic potash, and which shrinks and curls up on hot coals, exhaling an ammoniacal smell. M. Vauquelin thinks, however, that it appears an intermediate substance between albumen and fibrine, being less firm and elastic

in its texture than the latter, and more easily soluble in alkali. The substance which seems peculiarly to distinguish chyle is the fatty matter above-mentioned, resembling that of the brain, and which gives to chyle its apparent milkiness, and adheres to every coagulum formed in it by any re-agent.

An Attempt to analyse Silex. By Professor BERZELIUS. *Phil. Mag. Sept.* 1812. *(Extracted from the Stockholm Transactions.)*

THE attempts hitherto made to decompose silica by means of the electric pile having been attended with uncertain results, this eminent chemist endeavoured to separate the supposed metallic basis of this earth by mixing it with powdered charcoal and iron filings, and exposing the mixture in a luted crucible to a degree of heat sufficient for the fusion of iron, in hopes that an alloy of iron and *silicium* might be formed, from which decisive evidence of the existence of this metallic basis might be obtained. The probability of silex being an oxyd of some hitherto unknown basis, was suggested by the strong analogy of the nature of the alkalies and alkaline earths, discovered by the illustrious Professor of the Royal Institution of London.

Pr. Berzelius's first experiment was (in a few words) the following:—300 parts of iron filings, 150 of silex, and 66 of charcoal were exposed for an hour to a strong blast furnace, in a luted crucible. The mass, when cold, was taken out, the small metallic globules were extracted by the magnet from the adhering charcoal powder, and cleaned by rubbing on paper. These had a silver colour, were partly malleable, and partly brittle. Several of these globules were put into sulphuric acid, diluted with six parts of water, which began to act upon them only when heated. When all the soluble portion had dissolved, the form of the globules remained, some white, others black, and when calcined in an open fire they all became white or red, and were found to consist chiefly of silex, of the shape of the original globules, and about $\frac{1}{3}$ of their weight.

The experiment was repeated with a little variation. Equal parts of fine powder of flint and iron filings, and $\frac{1}{15}$ of their weight of powdered charcoal were made up into little balls with mucilage, and were then packed up in a luted crucible with powder of flints, and heated as before. On examination, when cold, the surrounding flint-powder was found unaltered; and the little balls were less perfectly fused than in the last experiment. The most globular of these were cleaned externally, and then immersed in nitro-muriatic acid, which acted on them with great violence, and, finally, left skeleton-balls, as it were, consisting

merely of silex of the shape of the original balls, and about 19 per cent. of their weight before the action of the acid.

Some of the small globules from the crucible were flattened and thrown into the acid, which acted as before, leaving portions of silex of the shape of the flattened globules, but much swelled, and which became semi-gelatinized on partially evaporating the acid with which they were penetrated.

From these experiments the author concludes that silex, when acted on by a carbon in a high heat, is reduced to a body which enters into union with iron without impairing its malleability, and, therefore, which must be a metallic body.

If it be affirmed that the melted iron is, in this process, only mechanically mixed with silex, and not really alloyed with the metallic basis of this earth, the author answers, that this is in direct opposition to all that we know of the usual habitudes of metals, with those pulvenilent bodies on which they exercise no chemical affinity. Professor B. tried to cement iron filings with silex and charcoal, at a temperature which would not fuse iron. The filings retained their form, but, on solution in muriatic acid, left as much as 6 per cent. of silicious earth.

The author then attempted a more accurate analysis of this alloy of silicium, iron, and carbon, in globules, the particulars of which are given with much minuteness, but though they agree pretty well in proving the essential facts, they fail in ascertaining relative quantities with any accuracy, chiefly owing to a quantity of fœtid oil, which is produced by the action of any acid upon these globules, when the product is received through water, and which oil derives its origin from a portion of the carbon contained in the alloy.

Having failed in this respect with the use of iron, the author endeavoured to alloy silicium with copper instead of iron, by a similar treatment with charcoal. The silicated copper was dissolved in nitric acid, during which a portion of carbon was deposited in the form of a brown powder, and another portion was converted into carbonic acid, precipitating carbonate of lime when passed through lime water. The copper dissolved into a clear blue fluid, which, in cooling, thickened to a blue jelly, and, after washing and drying, left a grey silicious earth, amounting to five per cent. of the weight of the copper.

Professor Berzelius suggests the trial of alloying silver with silicium, by fusion with charcoal, as likely to give more accurate results, as to the nature of this metallic basis, and the proportion of oxygen necessary to convert it into silex, but he concludes, that his experiments determine with tolerable certainty that silex, mixed with powder of charcoal, can be reduced by fusion with a metal; and that the base of this earth, when the metal is dissolved in acids, is again converted into silex by the absorption of about an equal quantity of oxygen.

Experiments and Observations on the Reduction of silicious Earths effected by means of Iron. *By* M. FREDERIC STROMEYER. *Read at the Royal Society of Gottingen, May* 4, 1811.—*Ann. Chim. tom.* 81.

SIR H. Davy's curious discovery of the metallic bases of the fixed alkalies and earths led to the examination of silex among other earths, but no satisfactory results with this earth had been obtained by any chemist, till Professor Berzelius attempted its reduction by heating it strongly with iron and charcoal, and succeeded in obtaining metallic globules soluble in acids, but with a distinct residue of silex as described in the foregoing article; whence he justly inferred them to be an alloy of iron and *silicium*, or the metallic basis of silex. The present very interesting memoir of M. Stromeyer contains a repetition of Berzelius's experiments with equal success, and the addition of several other facts relative to the property of this singular alloy.

The mode of operating was the following:—The ingredients were selected of as great purity as possible: the silex was a very pure quartzose sand employed for glass making: the iron was a well forged ductile metal soluble in nitro-muriatic acid without any appreciable residue: the charcoal was the lamp-black from pine wood to avoid any admixture of alkali which is found in all common charcoal of wood. Of these ingredients, 5 grammes of the silex, 7 grammes of the iron, in filings, and from 0.25 to 0.8 of the lamp-black were mixed with linseed oil to a paste, and put into a luted Hessian crucible, and heated intensely in a very strong blast furnace for an hour. If only 0.25 of lamp-black is used, the metallic alloy produced in the operation remains ductile, but a greater quantity renders it only semi-ductile, or entirely brittle.

The alloy of silicio-carburetted iron thus obtained is in the form of small globules differing in size, texture, appearance, and ductility; they may be separated from the surrounding mass of charcoal powder by the magnet and by rubbing them for some time between paper, and then they always exceed in weight that of the iron employed. Their size varies from that of a mustard-seed to that of a pea; their specific gravity also varies, but is always less than that of the iron employed, and even than that of any kind of iron or of steel. This alloy resembles steel in becoming hard and brittle by heating red-hot and quenching in water, and it also shews the iridescent colour of heated steel. It takes a very high polish, is a good conductor of electricity, and is strongly attracted by the magnet.

M. Stromeyer then gives the particulars of a very minute and apparently accurate analysis of several varieties of the metallic alloy thus obtained, in which he notices both the quantity of carburetted hydrogen given out during the action of acids, and the proportions of silex, iron, and carbon, separated by the different re-agents of the excess of the sum of the weights of these three ingredients over that of the alloy employed, which excess he attributes to the oxygen absorbed by the silicium during its solution in the re-agents employed.

The general result of these curious experiments is, that when silex, iron, and charcoal, are heated together very intensively, the silex is reduced to its metallic state, and the silicium, at this temperature, readily alloys with iron without materially impairing its ductility (in the proportion in which it can unite with this metal) but the silicium can only be separated, at least as far as we at present know, by those re-agents which restore its oxygen and reduce it to the state of common silex.

The author also compares the alloy thus produced, with that obtained by the use of common beech-wood charcoal instead of hemp-black, and with this latter alloy he finds a slight difference in the action of acids, as they dissolve much of the silex as well as the iron; whereas in the former alloy the silex is left undissolved, though in each case the silicium becomes oxygenated. This difference in the action of acids he attributes to the presence of a small quantity of potash in the charcoal, which probably is itself converted into potassium during the fusion, and thus a quadruple alloy of iron, carbon, silicium, and a minute portion of potassium, is produced.

The author gives the composition of five varieties of the triple alloy here analyzed, the most ductile and the most brittle of which are as follows:

	Brittle Alloy.	*Ductile Alloy.*
Iron	85.3528	96.1780
Silicium	9.2679	2.2124
Carbon	5.3793	1.6096
	100.0000	100.0000

And the composition of silex as inferred from the average of these experiments is about 46. per cent. of silicium and 54. of oxygen.

Chemical Researches on Log-wood. By M. Chevreul.—*Ann. de Chim. tom.* 81.

This memoir, which was read at the Institute in Nov. 1810, contains a very long minute, and (we suppose) accurate analysis

of this dying wood, in which the author describes more particularly a peculiar crystallizable substance containing the colouring matter for which this dye is valued, and to which he gives the name of *hæmatine*. The preparation and properties of this substance are the following:—A dry extract of logwood was first made by evaporating to dryness the watery decoctions of the wood, and by using much water and repeated digestion the wood was made to yield .25 to .3 of its weight to the extract. This substance was then separately examined by different reagents, and found to consist of a crystallizable substance, soluble in water, and of a brown uncrystallizable matter, much less soluble, and which appeared to owe the degree of solubility which it possessed to a mixture of the crystallizable substance. With these and other data, M. Chevreul proceeded to obtain this substance immediately from the wood. Some logwood was digested for eight hours in water at 120° to 130° Fahr. which gave an orange-red infusion that shewed small crystalline specula, when examined in sun-shine. This infusion was evaporated to the consistence of syrup, during which it deposited many crystals. The liquor was evaporated to dryness, thrown into alcohol, the alcoholic solution filtered, evaporated till very thick, and then a little water was added, which immediately caused the separation of a large quantity of the same crystals, covering the liquor with a golden pellicle. All the crystals were removed and slightly washed with alcohol and dried. That portion of the dried residue which refused to dissolve in alcohol was of a chesnut-brown colour, but was reddened by acids. When again digested with water, concentrated and treated with a little alcohol, it gave a fresh crop of crystals. From these and other experiments the author concludes, that the extract of log-wood is formed of two distinct substances, one highly soluble in water, crystallizable, and of an orange-red, turning rose-coloured by acids; the other, little soluble in itself, but intimately combined with, and solublé by means of the crystallizable matter, and scarcely to be separated entirely from it. When a first infusion of the wood is made, the crystallizable matter much predominates, and on concentration of the liquor many crystals are deposited; but after this the two principles are not further separable by mere evaporation, but it is necessary to add alcohol, which has a greater action on the brown matter than on the crystallized portion, and thus causes the latter to separate.

The properties of crystallized *hæmatine* are the following: It has a light rose colour with somewhat of the lustre of silver a little tarnished; when rubbed to powder, it is yellowish red, by transmitted light and a bright white by reflected light. Examined with a lens in the sunshine it appears in small brilliant

scales or globules. It is soluble in warm water, and again mostly separable by cooling. The solution is orange red. The colour is changed by the strong acids first to yellow and then to a rose red. Carbonic acid gives a yellow colour. All the alkalies and earths change the tint to a purple-red with a little cast of yellow. The colour is entirely destroyed by sulphureous acid and by sulphurated hydrogen after a digestion of some days, but with the latter substance is partly restored by heating the liquor. This colouring matter seems to be a much more delicate test of any slight excess of acid or alkali than either litmus or syrup of violets so as to detect a very minute deviation from perfect neutrality in the common neutral salts. When an infusion of logwood is mixed with alum, a violet-red precipitate is formed consisting of colouring extract and a subsulphate of alumine. Edulcoration with hot water reduces this to a simple combination of alumine and colouring matter.

When a few drops of solution of isinglass are added to a solution of pure hæmatine, no effect takes places at first, but in twenty-four hours a deposit of reddish flocculi is formed, consisting of hæmatine and gelatine. On the other hand, if the mixed solution of hæmatine and the brown coloured extract (such as exists in the infusion of log-wood after the first deposition of the coloured crystals) is treated with isinglass, an immediate and copious precipitate takes place. Here the author very properly remarks, that the mere circumstance of forming a precipitate with gelatine is not of itself sufficient to characterize the peculiar principle of tannin, since it is possessed, though in different intensity, by two substances so distinct as hæmatine and the brown colouring extract.

Observations.—This experimental memoir contains many other facts relative to the analysis of log-wood. The author's leading idea is, that this, as well as the other dying woods, contains oxalate of lime, resin, and animal matter, which, being insoluble themselves in water, serve as *mordants* to fix the colour in the fibres of the wood, and thus offer a most powerful resistance to the action of water and other solvents in extracting the colouring matter, and hence the difficulty of depriving these woods of their dye by any repetition of infusion or decoction. The author appears to have made out in a satisfactory manner the distinctive properties of his *hæmatine*, meaning thereby a crystallinable substance, in which alone seems to reside the red or purple colouring matter that gives to log wood its peculiar value to the dyer.

REVIEW OF SPECIFICATIONS OF PATENTS,

PUBLISHED IN THE REPERTORY OF ARTS, MANUFACTURES, &c. &c.

During the Months of July, Aug. Sept. Oct. Nov. and Dec. 1812.

MR. J. M. MAAS's *Patent for an Improvement in making Vinegar.—Dated Sept.* 1812.—*Repertory of Arts.*

THE object of the Patentee is to prepare a vinegar equal to the French white-wine vinegar, and his process is the following: The materials for fermentation are raisins, with their stalks, and water. The infusion of raisins is prepared in the proportion of 125lb. for each hogshead, and the vessel in which it is made is provided with perforated disks, one fixed near the top, and the other near the bottom, between which the raisins are laid, and hot water poured over them. The infusion stands for five days, a second is made of the same materials, and the whole is then transferred to the fermenting tuns, which are arranged close to the walls of a stoved close room, which is kept steadily at a heat equal to the highest summer heat in England. The fermenting tuns hold from five to fifteen hogsheads; each of them is furnished with a perforated disk fastened (parallel to the bottom) at fifteen inches from the top. The vats have each a pump and a wooden cock near the bottom. They are used in pairs in the following way:—On the disk of each vat closely pressed raisin stalks are laid up to the top of the vat and loosely covered. Then one vat of each pair is filled to the brim with the infusion of raisins, and the other only up to the perforated disk, leaving the raisin stalks in this latter vessel dry. At the end of every twenty-four hours, the filling of each vat is reversed, the liquor being pumped out of the full one down to the level of the disk, and transferred to the other which was before partly empty. This is continued for fourteen days, when the acetous fermentation begins to be well established, and then about three gallons of proof spirit is added to every hogshead of liquor, and the daily transferring of liquor still continued for about three months, when the vinegar is fit to be removed and clarified. This is done in the usual way, either by filling the casks with beach shavings, upon which the vinegar lying for a few days becomes clear and pure; or else by adding to the vinegar, a small proportion (about two ounces to each hogshead) of an acetous solution of isinglass, and in two days it becomes clear.

Observations.—There can be no doubt that these materials, and this process properly managed, will give good vinegar. The Patentee has not mentioned the use of yeast to begin the

fermentation, which probably is an accidental omission. With regard to the management of the fermentation, and keeping it up in a steady and moderate degree, by the ultimate transfer of the liquor to the raisin stalks; it is with very little variation the process actually used to finish the common London malt vinegar, the refuse of the raisin, and other fruit wine, being employed under the technical term of *rape*, and the rape tuns are worked in pairs, as above stated. The difference between the vinegar of the Patentee, and the common malt vinegar, consists chiefly in using only raisins, and in the quantity of spirit added after the fermentation is established.

Mr. GEORGE DOLLOND's *Patent for an improved Method of lighting the Compass, and for other Improvements relating to Ship's Binnacles. Dated Feb.* 1812.—*Repertory of Arts, No.* 124.

MR. DOLLOND describes his invention in the following manner, viz. It illuminates the compass by prismatic reflection; it applies a lens between the eye of the steersman and the compass, by which the compass is magnified: it adds springs, &c. to the compass.

There is a lantern, composed of metal, to which is applied a prism. This lantern contains a lamp of the usual construction, and the prism reflects the light upon the face of the compass. The form and position of the lanterns and prisms can be varied as circumstances may require.

The lens which magnifies the compass, must be of such focal length as not to confine the steersman to a fixed distance.

The card of the compass is so constructed, as to prevent the vibrations. This is obtained by a bar, or false needle, placed at right angles to the needle. The point on which the card traverses, is supported by two cylinders, in the interior of which is a spiral spring, for the purpose of preserving the point, and securing the card in its place, during any violent motion of the ship; and at each axis of the gimbals, is a spiral spring. The use of these springs is, to relieve the compass, when the ship is greatly agitated.

The Patentee states that, The advantages of the binnacle, consist in the steadiness and equality of the light, which, in the night, is obtained by prismatic reflection, and the facility and security with which the lantern may be removed to an inclosed place to be trimmed, for which, indeed, there is seldom a necessity, as it has been proved, that the lamp will burn without trimming from twelve to fifteen hours. The lamp being inclosed in a lantern, prevents the possibility of the light being blown out, or the oil falling on the compass.

The lens in the front of the binnacle, which magnifies the compass, is also a very considerable advantage, as it enables the steersman to see the point more distinctly; and the whole of the apparatus being inclosed, the light is prevented from appearing in the night to any person, except the steersman; and the weather, also, from affecting the compass.

The improvements, relating to the compass, are the following. It is suspended in gimbals, as usual, with the addition of a spiral spring to each axis. These springs relieve the compass, when any sudden or violent motion of the ship takes place. The compass card is so constructed as to prevent its vibrating, and is suspended on a spiral spring, acting with two cylinders. By this suspension, the point is preserved, and the card secured in its place, although the motion may be excessively violent.

Mr. Hardcastle's *Patent for an improvement on Cranes. Dated May*, 1812.—*Repertory of Arts, No.* 125.

The improvement connected with this machine, as stated by the Patentee, consists in causing the rope, or chain, employed in raising or lowering the weight, to wind upon two cylinders, of different diameters, turning with different degrees of velocity, but contrary ways, the rope, or chain, winding on one cylinder at the same time that it unwinds from the other; so that a weight, hanging by a pulley on the middle, or bite, of the rope or chain, is raised or lowered by the turning of these cylinders. For it is evident that the larger cylinder, or that moving with the greatest velocity, will take up the rope, or chain, faster than the smaller cylinder, or that moving with the lesser velocity. And since the two ends of the rope, or chain, fastened to each cylinder tend to turn them in opposite directions, and each sustains an equal weight, they counteract each other, and balance the weight. It cannot, therefore, run down of itself, and thus the greatest safety is obtained in raising or lowering it. One of the cylinders may be turned by hand, with a winch, or by a walking, or raising wheel, or by any other mode of applying power. The other cylinder is to be turned by toothed wheels, on the axis of each. To give the respective and required velocities, the cylinders may be of equal diameters, and the toothed wheels unequal; or the cylinders unequal, and the toothed wheels equal, as may be most convenient.

Observation.—Although the principle of this invention has been developped in more than one instance, yet if Mr. Hardcastle brings it into more general use, he will render a great service to the public.

Mr. JUSTICE'S *Patent for an Improvement in the Construction of Stove Grates, calculated to prevent or cure smoky Chimnies, and possessing other Advantages over the Stove Grates in common Use. Dated March,* 1810.—*Rep. of Arts, No.* 125.

THE stove grates, according to the specification of Mr. Justice's patent, are, in appearance, similar to the register stoves in common use, but connected, according to his statement, with the following improvements. The grate, or that part which contains the fire, instead of being fixed and immoveable in its place between the outside cheeks, as in the stove grates, or register stoves, in common use, is moveable upwards or downwards between the outside cheeks, so that it may be lowered, or sunk down even to the hearth when it is desirable, as where wood or turf is the fuel principally to be employed. Or, it may be raised or wound up to any desirable height, and at the same time suitable to the inside opening of the front. In this power of being moved and placed at any required height, it presents the advantage of enabling the possessor so to adjust it as to cure, or altogether to prevent that evil so generally complained of, namely, a smoky chimney: for, in most cases of smoky chimnies, the evil may be remedied by bringing the top, or lintel of the chimney, down to some certain distance from the grate, which shall be found to occasion precisely that draught of air which is necessary to carry up the smoke. But this mode of remedy would often be found to produce a deformity in an elegant room that would not be tolerated, nor would it be easy to adjust, without various trials, the precise height of the lintel which would produce the intended effect. But though the top of the lintel of the chimney cannot always be conveniently altered to produce the desired effect, the height of the grate may with perfect convenience, and without producing any unpleasant appearance to the eye. On this principle Mr. Justice rests the great value of his improved construction of stove grates.

Another advantage is stated, arising from the circumstance that the same key which makes the grate ascend or descend, gives motion to two or more plates of metal, fitted to the width of the front, which answer the purpose of what is commonly called a blower. This blower, by beginning to descend after the grate in its ascent has reached a certain point, prevents the necessity of raising the grate to such an inconvenient height as would sometimes be necessary in cases where the cure of a smoky chimney is difficult.

The Patentee, in pursuing the minuter parts of his specification, gives directions to the workmen respecting the right adjustment of the interior parts of his grate, which, in consequence of the peculiar property which it possesses of allowing the fire-grate to be raised and lowered, he wishes to be distinguished by the name of "The metastatic stove grate."

Mr. SMART's *Patent for a Method of preparing Timber, whereby the same is prevented from shrinking.—Dated May,* 1812. *Repertory of Arts, No.* 127.

IN introducing the specification of his patent, Mr. Smart premises—that, in many cases, the shrinkage occasioned in timber, by exposure to hot, or dry air, or to any circumstance, which extracts moisture from the pores of wood, is productive of injurious consequences. He prevents this effect, by a previous compression of the wood, by a proper application of mechanical powers, into a less volume than can be produced by the common causes, which occasion the shrinking of timber.

He states his invention to be particularly useful to coopers, vat-makers, and builders. In preparing staves for vats, or casks, he cuts the staves square on the edges, and passes them between a pair of rollers, prepared with bevelled grooves in them, so as to press the wood on the edges into the bevel, that is necessary to give the required rotundity, according to the width of the staves, which are to form the casks, or vats. He passes the heading through parallel rollers, loaded in proportion to the hardness, or thickness of the wood. For canteens, or small work, he presses the staves with a screw, press, or lever, which not only levels them, but by its action on the inner edges, gives them a degree of curvature which facilitates the subsequent cooperage.

The patentee states—that vessels made of staves, previously submitted to his process, will be always tight, whether full, or empty, the wood being pressed into a closer state than it could attain by shrinking. Nor do they require the insertion of rushes between the joints, which is no uncommon practice in forming casks and other vessels intended to contain liquors. He says, that the best performed rushing frequently gives way, in consequence of the shrinking of the timber. But that this evil is prevented by his invention, it being only necessary to press, what is commonly called the *crown* of the king-post, and also, the base of the truss into a less volume, than drying could ever occasion, before the insertion of the trusses. The boards to be employed for flooring, should be passed edge-wise between rollers, to close the fibres of the wood, before they are laid down on the floor.

Observations.—The value of Mr. Smart's discovery lies in the proposed compression of wood, by means of mechanical powers, into a less volume than can be produced by the common causes which diminish its bulk. If he has ascertained this by accurate and satisfactory experiments, he has rendered an acceptable service to the useful arts, and we sincerely wish he may receive the just fruits of his valuable invention.

M. CONSTANT's *Patent for a Method of refining Sugars. Dated Feb.* 1812.—*Repertory of Arts.*

THIS important patent contains the following distinct articles, *viz.*

1. The preparation of charcoal powder for clarifying the muscovado.
2. The mode of applying the charcoal to this purpose.
3. The construction of an hydrometer for finding the strength of the syrups.
4. The application of a damper to the fire under the sugar boiler.
5. The purification of the sugar in the moulds by the addition of finer syrups to expel the coarser ones.

These we shall mention in the above order.

1. Common charcoal of wood is first washed with water, then powdered in a mill, first grossly, afterwards very finely, and again washed with water, and formed when moist into cakes of the size of cheeses, dried moderately and kept for use.

2. A solution of coarse sugar in water is made of the requisite specific gravity (as determined by the hydrometer afterwards described), and when boiling, a quantity of prepared charcoal is added, in the proportion of from five to ten pounds to every hundred weight of raw sugar, the whole well stirred and boiled up briskly, after which the usual finings of white of egg, blood, or other albuminous material are stirred in, and by continuing to heat a proper time, the scum, consisting of the finings and charcoal and impurities of the sugar, rises to the top; the fire is then slackened, and after the liquor has remained at rest for a time, the scum is removed, and the clean syrup carefully filtered. The scummings are then boiled separately with clean water, and a second weaker syrup is obtained, which is used in the subsequent processes. This charcoal scum need not be used immediately, as it will keep for a month without spoiling by fermentation.

3. The hydrometer used by the Patentee is of the common form of a bulb with a graduated stem, and is divided into forty degrees, the zero corresponding with the specific gravity of pure water. Each degree equals $\frac{1}{240}$ part of the bulk of the whole bulb immersed. The advantage of regulating the specific gravity of the syrup before the addition of the charcoal is, that, as the syrup is too thick and heavy, the charcoal would not separate properly; and if it were too thin, the syrup would require a much longer boiling down before it is fit for the moulds, which continuance of heat would materially injure its

quality and colour. For sugars of ordinary quality, the boiling syrup is brought to 28 degrees of this hydrometer before the charcoal is added; and if the sugar is of good quality the syrup is brought to 30 or 32 degrees.

4. The fire damper, to which the patentee attaches much importance, consists of a plate of metal which can be immediately and entirely interposed between the bottom of the boiler and the fire, and thus instantly check the heat. Its particu'ar use is this: notwithstanding the care taken in removing the skimmings, it will happen that whilst the clarified syrup is boiling down to the proper consistence, a little of the finer part of the charcoal retained in the syrup will rise to the top, and when this is perceived, the fire is immediately damped and in a few minutes this remaining charcoal has settled at the top and may be removed without loss of time, and the fire again immediately made active by withdrawing the damper. The use of the damper also is stated to be that of preventing the sudden boiling over of the syrup which sometimes occurs, or removing the necessity of adding butter or fat to prevent such an accident, which is injurious to the subsequent crystallization.

5. For the refining of sugars in lumps or loaves, instead of the old method of claying, the patentee effects the same by the gradual percolation of purified syrup cold through the sugars in order to clear out the coloured syrup or molasses which occupies the interstices, between the crystals of the sugar at its first formation. Hence the importance that the purified syrup used for this purpose should be of a proper strength: for if too thick, it would not flow through the loaf with sufficient ease; and if too watery it would saturate itself with part of the crystalized sugar which it is only meant to to cleanse. The patentee describes the density required for this purpose which varies a little accordiug to the quality of the loaf for which it is used. Therefore, when the loaves of sugar are to be refined by this process, the upper part of the loaf, commonly called the fountain, must be taken off as usual with a knife till the sugar appears solid and firm, and the same then turned upside down in and along with its pot or mould; and after an hour (more or less according to the quality) the mould is struck against the block to separate the loaf, the hole at the bottom of the mould is plugged up, and the loaf is replaced with the point downwards to allow the syrup naturally contained therein, to settle to the bottom of the loaf. The fine syrup reserved for this purpose is then poured at top of the loaf (where the claying is applied in the common method), the quantity and quality of this fine syrup depending on the obvious quality and purity of the loaf itself; and after from

twenty-four to forty-eight hours the plug is withdrawn and the yellow dark coloured syrup originally contained in the loaf flows out, being driven down and replaced by the fine syrup added, which last remains in the loaf and appears to amalgamate with it. This previous turning of the loaves and plugging the moulds, is not absolutely necessary, but it prevents the spots and irregularity of colour in the loaves near the point, and by delaying the percolation of the fine syrup it makes the loaves denser and less porous. For loaves of inferior quality, the syrups flowing from the finer loaves will answer the purpose of purification, so that the same syrup may be employed for three successive operations, and may afterwards, without further preparation, be manufactured into lumps or inferior sugar.

Observations.—M. Constant's improvements in sugar refinements attracted much notice among sugar refiners when first announced.

The use of charcoal in clarifying many vegetable and animal infusions was first pointed out, we believe, by M. Lowitz of Petersburg, and the immediate improvement of the colour and quality of the coarsest sugar by simple filtration through fresh burned charcoal, has long been a common experiment. We believe that this part of M. Constant's improvement was attempted to be applied in the large way to sugar refining in London, but was soon abandoned, as not answering the expense and trouble of preparing the charcoal. It is possible, however, that the known and unprincipled obstinacy of the workmen employed in this line may have then (as has often been the case) intentionally defeated any attempted improvement.

But the most original and ingenious part of M. Constant's invention is undoubtedly the substitution of the clarified syrup to the common process of claying, and, if it answers the object of the Patentee, it must be a most important saving in the manufacture, as the water which soaks in from the wet clay, in the common way, produces a great quantity of syrup to mere waste, which must be worked over again and again, with all the additional expense of fuel and labour, and the constant deterioration of its quality that attends the long continued exposure to a boiling heat.

Mr. F. A. WINSOR'S *Patent for a Method of employing raw and refined Sugars in the Composition of sundry Articles of Merchandize in great demand, where it has not heretofore been used. Dated December,* 1811.—*Rep. of Arts.*

THE singular specification of this most singular patent is the following: "The component parts of sugar being 64 parts in "one hundred of oxygen, 28 parts hydrogen, and only 8 parts "of carbon, it will be allowed that, next to nitre, this salt "possesses the most inflammable and explosive qualities, ex- "cepting the oxygenated muriate of potash." Hence, if sugar, both raw and refined, be carefully dried, and reduced to fine powder by three or four hours trituration, and then mixed up with the usual ingredients of which gunpowder is generally composed, in the proportion of twenty-five parts in one hundred, it will be found to be equal to the force of such qualities of gunpowder as are intended to be produced by the admixture of nitre, sulphur, and charcoal. Or if three-fourths of gunpowder be mixed with one-fourth of sugar, the inflammable and explosive effects will be the same as with four parts of gunpowder. The Patentee adds, that a greater proportion of sugar may be added for fire-work powder. As a general conclusion, he adds, that sugar may be made to enter, in certain proportions, in all combustibles whatever.

Mr. NEEDHAM'S *Patent for a Portable Apparatus for brewing Beer and Ale from Malt and Hops. Repertory of Arts.*

THIS brewing apparatus is made by the Patentee so small as to brew no more than eighteen gallons. Its exact construction cannot be understood without reference to the plate, but it may in a general way be described, as consisting of a tinned iron cylindrical boiler, standing over a stove, and containing a smaller cylinder, perforated with holes, in which the malt is put, and a separate space for the hops and the water, which is put into the boiler, and surrounds the inner cylinder, has free access to the malt and hops, and makes a hot infusion, or wort, of the desired strength. The inner cylinder, with the refuse malt and hops, is then removed, and the boiler itself is used as the fermenting tun, where the wort, with the yeast added, is allowed to work the proper time, and is then tranferred to iron coolers connected with the apparatus.

Observations.—We are not able to speak from experience of the utility of this apparatus, but it cannot fail to suggest itself to the practical brewer, that as both the fermenting vessel and coolers are made of thin metal, and as the bulk of liquor is extremely small, unusual care must be taken to keep the room in which this apparatus is used of a proper temperature, and to guard against any accidental chill, which would be immediately communicated from the external air to the fermenting liquor, and might materially injure the process. As this apparatus is professed to be intended for family use, it would probably be consigned to the back kitchen or cellar, which, in winter, must render the use of it very precarious and difficult.

MR. ROBERT BILL'S *Patent for an Apparatus to facilitate the operation of washing Clothes, and other Processes necessary in family and other establishments. Dated March,* 1811.—*Repertory of Arts.*

MR. BILL'S apparatus consists of the following particulars:

First. A boiler, of a quadrangular form, made of some proper metal and of any required size; but from twenty-four to fifty inches in length, and from twenty to twenty-four inches wide, comprehends a sufficient variety for ordinary purposes. It may be of any depth, but in general eight inches will answer best. Round the exterior edge is soldered, or otherwise secured, to it, a water groove, two inches deep. A cock is inserted, to draw off the water when wanted, and a feeder vessel is attached, which communicates with this vessel, within about an inch of the bottom. This vessel is cased on the outside, within a tin covering, secured by soldering, and leaving an interstice of one inch, or thereabouts, between the case and the boiler. A steaming vessel is then adapted to the boiler. This vessel is made of tinned copper, or any fit metal, and of any necessary depth, but Mr. Bill prefers one of ten inches. The bottom of the steamer rests on the top of the boiler, and a projecting piece fits into the water groove of the boiler, of the same depth as the water groove, so that when the groove is filled with water, no steam can escape, but through certain openings in the bottom of the steamer vessel. These openings are of any size and number, according to the size of the steamer, but three, for one of fifty inches, are found sufficient. A tube, of one and a half or two inches long, is soldered into each opening from the boiler to the steamer, so that the liquid which is in the steamer, will not interfere with the water in the boiler, unless the depth exceed the height of the tubes, which must never be allowed. The steamer is divided into compartments, so as not to render

the covers too heavy, and each of the divisions communicates with the other. The plates which form the divisions, not being closed at the bottom, the top edges of this vessel, and each division, are furnished with water grooves, so that the rims of the covers may rest in the grooves filled with water, and prevent the escape of the steam. Doubled covers are fitted to these divisions, the interior of which is metal, soldered to rims, which project sufficiently to rest on the bottoms of the water grooves. These rims receive the exterior upper covering, made of wood or metal, but wood is preferred, which should be painted, to defend it from the wet sides of the steamer; and the rims, like those of the boiler, are covered with tin or other matter, leaving a space from the sides of the interior vessel, of about an inch. This space, both in the boiler and steamer, is filled with cotton, or some non-conducting substance, so as to prevent the escape of heat. To the end of the steamer is attached a metallic box, three or four inches deep, twelve or fourteen inches long, and about six inches wide. On the top holes are made to receive saucepans, fitted tight into them. An opening, of about an inch, is made from the steamer to this box, for the passage of the steam, and another opening at the other end of the box, for the steam to pass away; to this opening is fixed, a metal tube, to conduct the steam wherever desired. Proper vessels, fit for holding the object to be operated upon by the steam, must be placed in the steaming vessels; whether the object be to cook meat or aid in the operation of washing clothes, the end will be answered. For washing, the clothes not made of animal matter, should be well soaked in a strong lixivium of alkali; but if animal, well soaped and laid in the vessels, supported above the entrance steam tubes, on wooden racks. The longer the steam is allowed to operate upon them the better; and it will be found, on taking them out and rincing them in water, that, at least, half the labour by hand will be saved in regard to cleaning clothes.

Secondly. Roasting apparatus.—A cast iron box is provided, of a proper size, and open on one side. A box, twelve inches by nine, and thirteen inches deep, with sides projecting three or four inches from the open part, is large enough for the largest boiler. This box has a grate fixed in it, at six or seven inches from the top. A cast iron plate is fitted upon it, with an opening, so that the top edge of the box just passes through the plate. A flange, cast round three sides of the box, receives the plate to rest upon it. A cast metal front is provided with one opening, about one inch wider than the box; and another wide enough to introduce whatever is to be placed in the roaster. The ends and back may be made of metal, or bricks, or stone, but bricks are preferred. The plate, through

which the fire boxes pass, covers the whole of this chamber, which is about thirteen inches deep, and stands on a platform of masonry, six or eight inches high. The cheeks of the fire box project through the front plate, leaving a space of about half or three quarters of an inch, on each side. Through these openings the air passes into the air chamber, and not only heats, but ventilates it in such a manner, that any thing, placed in it, is effectually roasted. A tube is inserted in this chamber, under the covering plate, at the end opposite the fire, and thus a current of hot air is established through the roasting apparatus. A door is adapted to the mouth of the box, and a slide, with grooves on the interior sides of the fire box, is used. The fuel is introduced by a feeder, placed in such a manner, that it may pass readily into the fire box, by means of an opening in the frame: The frame intended to be placed on the covering plate of the roaster, is about four inches deep, and fits the boiler as an interior projecting ledge, on which the boiler rests. This ledge is about three inches from the bottom of the frame. A rib of iron passes down about the middle, to divide and form a return fire. An opening in the end of the frame, admits the fuel, and another opening is left for the smoke to escape, after having passed round the end of the flue-divider. It is stated, in the specification of the patent, that this apparatus may be used as a house-warmer by a few additions.

Observations.—The very complex construction of Mr. Bill's apparatus compels us to condemn it *in toto*.

Its application to the washing of clothes, professes only *half* the operation of that domestic employment; and from long experience, we have witnessed the discarding of machines for this purpose, which have *promised*—aye, and have *secured* too, the *completion* of it, and without the aid of female hands; the general adoption of them having been found impracticable, in consequence of the operation of principles, which are unconnected with a philosophical review. And we do conceive, that few cooks, male, or female, would encounter the management of so complex a machine as Mr. Bill's roasting apparatus.

Mrs. GUPPY'S *Patent for Improvements in Tea and Coffee Urns. Dated March*, 1812.—*Repertory of Arts, No.* 123.

MRS. Guppy causes her tea and coffee urns to be constructed in the usual forms for containing the water, and communicates heat to these vessels by the application of a lamp, candle, or heater of metal. But she varies the forms, so as to allow a small vessel to be suspended within the upper part of the urns,

in such a manner, as that the suspended vessel shall receive heat from contact, or immersion in the heated fluid, or from the steam, or vapour, issuing therefrom, and which vessel is formed capable of receiving one or more eggs, and of boiling the same.

She also varies the form of the cover of the urn, so as to afford support for a plate, to contain toast, or other refreshment, to be kept heated by the steam from the urn.

Observations.—If a trifling luxury (the boiling of eggs) at the breakfast table of the opulent, be worthy of a separate and expensive apparatus, surely Mrs. Guppy's invention, which is intended, and perhaps calculated, to render this luxury less expensive, by simplifying the means of procuring it, will entitle herself to the thanks, and her invention to the adoption of the sons of fortune!

MR. JEREMIAH STRELE'S *Patent for an Apparatus for distilling and rectifying Spirits.—Dated Feb.* 1812.—*Repertory of Arts.*

THE invention of the Patentee consists in an apparatus combining two stills to be heated by steam, and so connected together that the same steam will heat both at the same time. The apparatus given in the accompanying plate may be understood, by supposing a common cylindrical boiler or copper, with another similar vessel, considerably smaller, suspended in the middle of the first; and each vessel being closed at the top, and furnished with a still head, to convey the vapour arising from the heated contents. The space between the inside of the larger, and the inside of the smaller boiler, receives the steam by which each vessel is heated, and has its regular steam and discharging pipes.

Observations.—The only invention, claimed by the Patentee, is this arrangement of his boilers by which two vessels can be heated by the steam introduced and interposed between them. It is obvious that as the capacity of the outer vessel is diminished by the whole size of the inner vessel, and by the intermediate space for the steam; a much larger quantity, than usual, of metal and workmanship is required for any given capacity of this outer vessel, which forms a kind of hollow plating or circular pocket round the inner one. At the same time, however, it offers a very large surface to the steam, which may, in some measure, compensate for the disadvantageous manner in which the heat is applied to this vessel.

WILLIAM EVERARD BARON VON DOORNICK'S *Patent for Soap to wash with sea Water, hard Water, and soft Water.—Dated April,* 1812.—*Repertory of Arts.*

THE soap to be used with sea water is made in the following way:—One hundred bushels of crude or unprepared bones are ground to a fine pulp, by a proper mill, and boiled in an iron pan for twenty-four hours, with about 500 gallons of weak soap lees, adding the pulp gradually and constantly stirring the mass. The soapy matter thus produced is then scummed from the top of the spent liquor, and removed to another soap pan, and finished by the successive addition of lees in the usual way of soap making. Lastly, 10 cwt. of calcined bones in fine powder, and previously macerated with 1000 gallons of cold water, are added to the soap, and the whole is finished in the usual manner. Sometimes the Patentee uses a mixture of tallow or other fat with bones as the basis of the soap, but he does not consider this as essential.

The Patentee's improvement for the manufacture of soap for common washing with soft water, consists merely in the substitution of the raw bones, either wholly, or in part, to the usual oily ingredients of soap, and omitting the calcined bones.

For some other patents of a similar nature see, our preceding volumes.

Mr. JAMES ADAM'S *Patent for a Method of drying Malt, and all Kinds of Grain and Seeds, dated Nov.* 1811.—*Repertory of Arts.*

THE sole invention claimed by the Patentee is contained in the following words, "My said invention of a method of drying malt, "and all kinds of grain and seeds, consists in the application of "heat from steam to the above purposes." The Patentee adds, that this may be most conveniently done by confining the steam within chests or hollow cylinders, or on a floor of metal, pottery, &c. which will transmit the heat without allowing the moisture. He gives the construction of a hollow iron floor, which he proposes as a convenient method, but he claims as his patent-right any mode whatever of applying steam to the dying of malt or any kind of grain. It does not appear that the iron floor which he proposes has ever actually been constructed, or that the comparative advantage of the different methods of steam and kiln drying has been established experimentally.

Mr. BLENKINSOP'S *Patent for certain mechanical Means of conveying Coals, Minerals, and other Articles. Dated April*, 1811.—*Repertory of Arts, No.* 123.

MR. BLENKINSOP constructs, on the road over which the conveyance of heavy articles is to be made, a toothed rack, of cast-iron, having teeth standing either upwards or downwards, or sideways, in any required position. He continues this toothed rack as far as may be required, by the addition of any number of similar pieces, according to extent. With any carriage required to convey goods along the said road, he connects a wheel, having teeth at the circumference thereof, so formed and placed as to become connected with the teeth of the rack, when the carriage is suitably placed upon it. He causes the said wheel to revolve, and drive the carriage along, by the application of any such well-known power as can be placed upon and carried along with the carriage, preferring the use of the steam-engine to any other first mover. He farther connects the wheel with the first mover by a crank, assisted by a fly, or other well-known method; and he makes the connection either directly with the arbor of the wheel, or indirectly, by other wheel-work, when the crank, or other driving-piece, cannot, with convenience or effect, be fixed upon the arbor of the wheel. In order to render the motion of the carriage more easy, he avails himself of the expedients heretofore used for the improving roads; such as platforms, pavements, connected timbers, and more especially the iron railway, which, in every instance, he prefers for the furtherance of his views. In this case, he connects his longitudinal pieces with the rail road itself, or otherwise, and sometimes (which he prefers) he casts one of the sides of the rail road with teeth, so that the same side shall constitute a toothed rack, and, at the same time, afford a regular and even bearing for the wheels, and for the toothed wheel, which (if its planes be vertical) may be made with a side run, to bear upon the smooth part of the rail, and prevent the teeth from locking too deep. And, lastly,—he gives motion to other carriages, by attaching them to the carriage upon which the first mover is placed; and these other carriages are fitted up, as usual, without the toothed wheel. Where, also, it may be preferred, he makes use of two toothed wheels, acting upon correspondent racks on each side.

Observations.—Mr. Blenkinsop's invention appears likely to answer the useful purposes stated in the specification, provided the expense, connected with the construction of the toothed racks, and corresponding wheels, be not found too great for its adoption.

Messrs. KELLY *and* VAZIE'S *Patent for Improvements in the Construction of Arches, and other Erections, or Buildings, which they denominate* "MOORE'S *Modern Architecture.*" *Dated January*, 1812.—*Repertory of Arts, No.* 126.

IN forming the first horizontal course of bricks in the foundation of a wall, of the breadth of fourteen inches or upwards, the patentees place in the inside thereof a hard brick, in a perpendicular position, with its edge towards the front or end of the wall, at the distance of four inches and a half from the left end of the same. They also place vertical bricks, at the distance of six feet from the centre of each other, in succession, throughout the whole length of the wall. In forming the second course, they place, in succession, a perpendicular brick, at the distance of two feet from the centre thereof, to the centre of the vertical bricks built in the first course. In forming the third course, they place a like vertical brick, at the distance of two feet from the vertical brick built in the second course. And in forming the fourth course, they place a like vertical brick immediately above each vertical brick situate in the first course. And against the side of each of these columns, as they ascend, they place other vertical bricks, the middle of one brick being opposite to the end of the other. This process is continued to the top of the wall. Or this improvement may be obtained in the following manner, viz.—

In forming the first horizontal course of bricks in the foundation of a wall, of the breadth of fourteen inches or upwards, they place, in the inside thereof, a hard brick, in a vertical position, with its edge towards the front or end of the wall, at the distance of four inches and a half from the left hand end of the same. They also place in succession vertical bricks, at the distance of three feet from the centre of each other, throughout the whole length of the wall. In forming the second course, they place in succession a like vertical brick, on the right hand side of the vertical bricks built in the first course. A vertical brick continues to be placed in like manner on each course, until the wall is raised ten courses, when the vertical bricks begin to be placed on the left of the former, and continue for ten courses more, and so on, to the right and left in succession, until the wall is raised to its due height. In building a wall up a hill, the column of vertical bricks continues pointing in one direction up the hill, without changing the course to the right and left. This improvement may also be obtained by the following method:—

In forming the first horizontal course of bricks in the foundation of a wall, of the breadth of fourteen inches or upwards,

they place in the inside thereof a hard brick, in a vertical position, with its edge towards the front or end of the wall. At the distance of four inches and a half from the end of the same, they also place like vertical bricks, at the distance of six feet from the centre of each other, in succession, throughout the whole length of the wall. In forming the second course, they place a like vertical brick in succession on the right hand side, at the distance of eighteen inches from the centre thereof, to the centre of the vertical brick built in the first course. In forming the third course, they place a like vertical brick in succession, at the distance of eighteen inches from the vertical brick built in the second course. In forming the fourth course, they place in succession a vertical brick, at the distance of eighteen inches from the vertical brick built in the third course. And in forming the fifth course, they place in succession a vertical brick above each of the vertical bricks situate in the first course, being separate therefrom by one horizontal course of bricks. And against the side of each of these divided columns, as they ascend, they place other vertical bricks, which unite the column.

Double calcined bricks are advantageously applied as vertical bricks. The horizontal courses may be formed in any usual way, care being taken that the vertical bricks be firmly fixed with mortar or cement. Here it is necessary to explain, that although the distances between the vertical bricks are expressly stated, yet various deviations or alterations may be made, as well as in the figure, or inclination, of the vertical bricks, as circumstances may require. And that, in proportion to the addition or reduction of the pressure, the distance between the vertical bricks may be decreased or increased, which latter may be extended to forming each column of a single row of vertical bricks, or even to the application of the vertical bricks apart from each other. These processes are equally applicable to building with stones, or other hard substances, vertically placed.

Observations.—Architecture having engaged the skill of men of celebrated abilities for many ages, it was not probable that any circumstances of consequence in the science should have escaped their attention; yet the existing practice in building brick walls offers fair ground for submitting a very considerable improvement.

The English, Flemish, and Lock bonds comprise the different modes by which brick walls are erected. These are distinguished by the manner of connecting the bricks in each distinct course; but the courses themselves are separated by a

regular smooth joint. The defect occasioned by this disunion of the courses is attempted to be remedied by placing bond timber longitudinally in the walls. But this is attended with evil consequences in case of fire. For when the bond timber is destroyed by the violence of the heat, the walls become incapable of bearing their own weight and fall down; and the flames, increased by communication with the open air, spread rapidly to the adjoining buildings.

To guard against calamities by fire, the Legislature have provided, that no timber shall be placed in the party-walls within a specified distance of a chimney, and that these walls shall be of a thickness corresponding with the rate of the building. This provision is the most effectual of any yet offered. But it will continue defective as long as these walls are suffered to contain a large quantity of combustible matter as part of their substance.

The improvement offered by the Patentees consists in uniting the brick work into one solid mass, by placing bricks vertically in the inside of the wall, either in a direct or varied course, from the foundation to the top of the building. This mode of forming brick work will greatly reduce the risk of fire. And in all cases of forming embankments, building docks, locks, bridges, or other walls, of the breadth of fourteen inches or upwards, this method of bonding the work will yield great strength and security.

AGRICULTURE.

On Sir Joseph Banks's proposal to sow Tail Wheat. By A SUFFOLK MAN.—*Agricultural Magazine, No. 57.*

The writer states, that hearing of the proposal of Sir Joseph Banks he was induced to sow a few drills of screenings, intermixed with drills of the best seed wheat. The inferior seed was sown very thick, and to his great surprise, there was no perceptible difference on vegetation between the best and the worst; there was, however, no expectation of the equality being preserved till harvest.

Observation.—Though Sir Joseph Banks, Sir John Call, and a few other gentlemen, continue to sow inferior seed wheat, we cannot say that we have yet sufficient tests from experience to induce us to recommend a practice so entirely at variance with the opinions of all agriculturists of the old school.

On the Dorset Scythe; and mowing Wheat. *By* Mr. JAMES BRIGHTLEY.—*Agricultural Magazine, No. 58.*

IT is noticed that a shorter and lighter scythe is used in Dorsetshire, for mowing both grass and corn, than the scythe of either the Midland or Northern Counties. With this scythe, though a man may not take so heavy a swathe, he will, by making quicker strokes, cut down more grass in a given time, at a less expense of muscular exertion. This scythe may be used either without or with a cradle, and, with this addition, is the usual implement for cutting down wheat, which is bound into sheaves in the same manner as when reaped; and the practice is thought to be in no way disadvantageous to the farmer.

Observation.—We are glad to see the customs of particular counties noticed in such publications as the Agricultural Magazine, because we conceive that agriculture can be in no way more extensively benefitted than by making generally known the peculiar customs and practices of particular districts.

Description of Small's (or the Scotch improved) Plough. *By* E. *Agricul. Mag. No. 59.*

As this is not a new implement, but merely a revived description of one which has been many years in use, we need only to say that it is the Scotch Plough, having the mold board and parts most in wear covered with iron plates; and that the use of it has been in a great measure superseded by the introduction of the cast iron mold board.

On the Culture of Timothy Grass in Scotland. *By* MR. J. LAWRENCE, *of Somers Town.—Agricul. Mag. No. 59.*

THE Timothy grass *(phleum pratense)* is generally reckoned an American grass; it is sown in the spring at the usual time, and will grow to the height of four feet on good ground, particularly if it be moist. Mr. Lawrence has tried it upon newly improved moss, and upon dry gravel, and has found it superior to rye-grass in both situations.

When used as green food it may be cut twice or three times in the season, and when intended for hay it should be cut a full week before it flowers: ten pounds of seed are stated to be sufficient for an acre; and if intended for pasture white clover may be advantageously mixed with it.

An account is given of two crops of this grass in Orkney, where it is found to be excellent pasture for horses, and the produce of the hay was more than four tons per acre.

Observation.—This communication from Mr. Lawrence is certainly favourable to the introduction of Timothy grass into more general culture; but it would have been more satisfactory to us, if he had published the letter itself which he received from Orkney, instead of his own account of that letter.

On cuttings of Potatoes preserved for Seed. By POT-SOS.—*Agricultural Magazine, No.* 59.

Experimental Crops of Potatoes; by SUSSEX —*Agricul. Mag. No.* 59.

On taking two Crops of Potatoes within the Year. By Mr. JAMES BRIGHTLEY.—*Agricul. Mag. No.* 60.

THERE is so little of novelty or merit in any of these Papers, that we have deemed them unworthy of separate notice.

On feeding Horses. By C. M.—*Agricul. Mag. No.* 59.

On Goose Grass, as Food for Horses. By C. M.—*Ibid.*

THE most curious paragraph in the former of these Papers is an assertion, that during the scarcity some years ago, a farmer in Hampshire supported his horses well and in good heart for three months in the Autumn upon haws or white-thorn berries, two bushels of which were found equal to one of oats!—Notice is also taken of a practice on the Continent of boiling hay and corn for horses, but this is said to affect their bowels!!

In the second Paper goose grass, which is refused by almost all animals, is recommended as food for horses!!!

Observations.—These two Papers recalled to our recollection some essays formerly noticed by us on hay tea, and sun-flower seed for swine, that we could not forbear exclaiming; "Aut John Saunders redivivus, aut Diabolus."

On Merino Sheep and Crossing. By SPECTATOR.—*Agricul. Mag. No.* 60.

THE writer considers that all results of experiments, obtained through the medium of bailiffs, are not to be relied on; and he advises that Merino sheep, and all the several crosses con-

nected with them, be fairly tried in several instances by grass feeding only, to ascertain the superiority of the mutton, for he conceives the question as to wool to be at rest entirely.

Observation.—We cordially concur in the recommendation of this writer, as well on his own arguments, as because the superiority of one breed of sheep over another in common grass feeding is of the most importance to the public in general.

On Chicory. By CULTIVATOR MIDDLESEXIENSIS.—*Agric. Mag. No.* 60.

A PAPER apparently printed for the purpose of giving renewed circulation to an anecdote of Mr. Arthur Young's hogs' dislike to this plant. The writer limits himself in his eulogium of chicory to the single circumstance, that it will keep beasts in store order.

On the Culture of Lucerne. By Mr. JAMES BRIGHTLEY.—*Agricul. Mag. No.* 60.

WITHOUT enquiring into the reasons why lucerne is so little cultivated, Mr. Brightley states that a gentleman of his acquaintance has a field of lucerne of six years standing, where weeds have almost entirely choaked the crop, notwithstanding the greatest attention has been paid to hoeing it.

Observation.—There was no occasion for Mr. Brightley to commence an elaborate enquiry to ascertain that, which was proved by the most incontrovertible facts of ocular demonstration.

On the Advantages of permanent Pastures. By Mr. ROBERTSON.—*Farmer's Mag. No.* 51.

AFTER noticing the remarks of Sir John Sinclair, that Mr. Brown and Mr. Rennie had ascertained by experience that on dry land grass of two or three years old is as good as that of twenty, the writer offers many reasons for doubting the truth of this conclusion, and observes, that though he does not contend for either landlord or tenant to lay down grass with a view to see it permanent old pasture, yet he would have any gentleman, who is so fortunate as to possess such property, think

well before he allows it to be opened; since though new sown clover and rye grass may be earlier than the richest meadow, yet after Midsummer the latter is infinitely before the other for the purpose of fattening heavy stock of all descriptions; nor could oxen of 85 or 90 stone weight be fed on any other; and these are the kind of stock best fitted for victualling the navy.

Observation.—The evils resulting from ploughing up old pasture land in every view of *permanent* advantage have always appeared to us so obvious, that we wonder any advocate has been found for a contrary practice. It can never be done without leading to repentance, when it is too late to remedy the mischief.

Account of a new Apparatus for yoking Horses in Thrashing Machines, by which their Labour is rendered more equal and steady; invented by WALTER SAMUEL, *Blacksmith, of Niddrey, Linlithgowshire.—Farmer's Mag. No.* 51.

THIS apparatus is a contrivance of ropes and pullies fixed at the top of the horse-wheel in such a manner, as that the stopping of one horse does not leave the work upon the other, but suspends it altogether. It is impossible to convey any idea of the application of the apparatus without the assistance of the plate which accompanies the original article; but it appears to us to be of too complex a nature to be fitted for general use.

On the Causes, Prevention, and Cure of a destructive Malady among Sheep; by the ETTRICK SHEPHERD.—*Farmer's Mag. No.* 51.

On the Diseases of Sheep; by the ETTRICK SHEPHERD.—*Farmer's Mag. No.* 52.

THESE two Papers, though extended over twelve pages of letter press, are merely a description of the disease called *sturdy*, or *water in the brain*; and the method of cure. When divested of extraneous matter, all the information they contain is, that the disease is probably occasioned by the back of the animal being exposed to cold and wet, and that a cure may be obtained by introducing a sharp knitting needle through the nostril into the cavity of the skull, so as to effect an opening by which the water may be discharged.

Observation.—These apparently elaborate essays on certainly an important subject are only parts of Mr. Hogg, the Ettrick Shepherd's book on the management of sheep, disguised by appearing in different language.

On the binding and stooking of Grain. By a BANDSTER.—*Farmer's Mag. No.* 51.

On the Binding and Stooking of Grain; in reply to a Bandster. By J. G. F.—*Former's Mag. No.* 52.

THE question contended for between these literary combatants is, "whether it is most adviseable in stooking grain to place the corn knot of the sheaf on the outside or the inside of the stook, or shock. And if any of our readers are inclined to waste their time in entering into the *merits* of the discussion, we refer them to the original Papers.

Account of a small Threshing Machine. By J. P.—*Farmer's Mag. No.* 52.

THIS machine scarcely differs in construction from those usually made, except being smaller in size, and the drum is turned by hand with the assistance of a multiplying wheel to give the necessary velocity. It is said to thresh about two hundred sheaves in an hour, and the price is given at eight pounds.

Observation.—An implement of this kind will doubtless be found useful to many small farmers; but as far as our own observations have made us acquainted with similar machines, they are extremely liable to be out of repair, and are of very uncertain durability.

On a Reaping Machine, invented by MR. SMITH, *Manager of the Cotton Works at Deanston, Perthshire, which worked for the premium of £500, offered by the Dalkeith Farming Club.—Farmers' Magazine, No.* 52.

THE machine was impelled forward by a horse in a pair of shafts behind the machinery, which, though awkward in appearance, is easily accomplished: the diameter of the cutter was four feet, and the quantity cut in an hour was more than three roods: the greatest defect was the manner in which the corn was laid down when cut, as the angle with the line of draft varied according to the quick or slow pace of the horse.

Observation.—There is no doubt that much benefit would result from a perfect reaping machine; but Mr. Smith's does not deserve that character, though merit is due to him for having made some advances towards perfection.

A cheap Method of hummelling Barley. By S.—*Farmers' Mag. No.* 52.

THIS method is, after the corn has been threshed by the machine, to take off the cover of the drum, and put on another lined with tin, having small holes perforated in the manner of a grater, with the rough side outermost, about three sixteenths of an inch wide; the barley is then carefully directed on the threshing table between the rollers, and the machine turned with considerable velocity.

Observation.—This method seems effectual for the purpose intended, but the danger to the labourer who puts the corn to the feeding rollers, lest his fingers should be drawn in with the corn, will always be an obstacle to its general adoption.

The Culture of Fiorin recommended in the Hebrides, or Western Isles of Scotland, in a Correspondence between DR. RICHARDSON *and* MR. BROWN, *of Edinburgh.*—*Farmers' Mag. No.* 52.

THE two letters which form this correspondence, contain nothing new respecting either Fiorin grass itself, or the inducements to its cultivation, except that Mr. Brown agrees in opinion with Dr. Richardson, that Fiorin may be advantageously cultivated in the Western Isles of Scotland, for the purpose of clothing with pasture the loose blowing sands, which are so prevalent in all the Hebrides.

Correspondence between DR. RICHARDSON *and Mr.* THOMAS TANNER, *of Urchfort, Wilts, on the Fiorin Grass, in a Series of Letters.—Agricultural Magazine, No.* 61 *to* 66.

MR. TANNER having stated, at the December Meeting, in 1811, of the Bath Agricultural Society (of which he is a member), an unfavourable opinion of the merits of Fiorin grass; these sentiments were reported to Dr. Richardson, who, feelingly alive to the reputation of his favourite grass, addressed a letter to the secretary of the Bath Society, requesting that

Mr. Tanner would re-state the arguments he had adduced at the Meeting in a letter to himself, that the question might be fully and fairly argued.

In conformity to this request, Mr. Tanner states, that in the introductory part of his speech at the meeting, he had endeavoured to remove an error fallen into by some of the early writers on agriculture, that the grass of the Orcheston meadow was the *agrostis stolonifera*; for that on examining the meadow in the latter end of may, he found the bulk of the crop to consist of the poa trivialis, the flote fescue and the meadow foxtail, while the agrostis stolonifera was to be found only in ditches and other moist places, but not sufficiently advanced in growth to be touched with the scythe; the meadow was then in swarth, and the grasses in a couchant state, striking root at the joints, and affording specimens five or six feet in length. The fiorin was represented to be an autumnal grass, and not in perfection at that early period; and this was adduced as a proof that the meadow in question was no evidence of the excellence of the fiorin. Mr. Tanner states, that he then proceeded to describe the fiorin and its habits—that it was not a couch grass, though it had been often mistaken for the agrostis repens, but was, like that, fond of shade and moisture, abundant in stalk but often deficient in foliage—and contended that from its growing best in the shade, and chiefly in the autumnal months the juices could not be matured by the Sun's influence—that for this reason, meadows, fed late in the spring, and mowed after July or August, never produced hay so fattening as those mowed in June, consequently fiorin grass cut in the months of November or December, however dry it might be, could not be made into nutritious hay—that he observed that it might be kept in a succulent state for months, without any danger of being spoiled from fermentation or putrefaction: and concluded by remarking, that the acreable produce of fiorin would never equal a crop of turnips, rape, or rutabaga.

Dr. Richardson, in answer, places himself first at issue upon the point that the predominant grass of the Orcheston meadow, is the agrostis stolonifera or Irish fiorin grass; an opinion he had repeatedly sustained, and particularly in a Memoir to the Board of Agriculture, noticed by us in a preceding volume. In support of his opinion, he demands whether the *poa trivialis* and the *alopecurus pratensis* are stoloniferous in Wiltshire, producing specimens of five or six feet long—or whether these were not in reality the stolens of the fiorin? and insinuates that Mr. Tanner's assertion must have originated in mistake; at the same time insisting that the real question is—not what species of grass produces such enormous crops at Orcheston, but whether the agrostis stolonifera, or fiorin, does not actually produce crops

of equal value with careful cultivation. He observes, that the terms vernal and autumnal are applicable to the grasses of the *culmiferous* tribe, which advance to a point of perfection determined by their inflorescence: while the grasses of the *stoloniferous* tribe have no point of perfection, their inflorence not repressing their luxuriance, but their stolones continuing to advance with redoubled vigour, until they accumulate into a mass of formidable thickness; and hence presumes, that the distinction between the *stolones* and *culmi* of the grassy tribe, have escaped the attention of his opponent, whose arguments against fiorin are put with irresistible force on the supposition that it is a *culmiferous* grass, but quite inapplicable to one of the stoloniferous tribe. He admits that fiorin, grown in the shade, may be deficient in crop when mown, but appeals to the fact of some parcels of hay sent to the Bath Society, being all equal in quality, though mown at different times between June and February; and he allows that the incorruptibility of fiorin grass, may arise, not from the principle of life with which it is endowed, but from deficiency in gas. The universal deficiency of late crops is fully admitted, but the inference that fiorin grass cannot produce good hay in November and December is as strongly denied. Dr. Richardson insists that the essential difference between *culmi* and *stolones* must be thoroughly understood, before a conviction of the superior value of fiorin grass can be obtained: and therefore gives an epitome of the natural history of each of these distinct productions of the grasses. *The culmi* he describes as the seminal apparatus provided by nature for the continuance of the species advancing in stated periods to their inflorescence, when they are in their highest perfection, losing little until the seed ripens, then rapidly falling off, the first symptom of decay appearing at the root. *Stoloniferous* grasses are noticed as having a seminal apparatus like the others, but it is their nature early to shew another sort of production, equally calculated for the propagation of the species, namely, long flexible strings, for a while soft, tender, and incapable of being preserved, but having once obtained perfection, they never lose it, having no falling off, as the culmi, but lengthening with increasing rapidity, and adding prodigiously to the quantity of the crop, without suffering deterioration in quality or manifesting symptoms of decay. With respect to the superior weight of crops of turnips and rutabaga, it is treated as an ingenious stratagem to draw the attention from the principal point of the argument, it never having been contended that any species of hay possessed fattening powers equal to the rutabaga, as a steady, fresh, green food from November to May, but only that fiorin hay possessed a superiority over common hay in quantity, quality, cheapness,

rapidity of growth, facility of saving, predilection of cattle, and as communicating extraordinary flavour, and richness to milk.

Mr. Tanner, expressing surprise that any gentleman, so intelligent and correct as Dr. Richardson, should impute error to another on merely imaginary grounds, vindicates his knowledge of the distinction of grasses, and again asserts, that the grasses of the Orcheston meadow are chiefly the *poa trivialis* and *alopecurus pratensis*. He refers, in support of the justness of his assertion, to Curtis's Essay on the British grasses, who declares it to be no small recommendation of the *poa trivialis*, that it is a principal grass in that uncommonly productive meadow, near Salisbury; and he fully evinces that he is not ignorant of the distinction between *culmiferous* and *stoloniferous* grasses. And thus taking leave of the question, as relating to the Orcheston meadow, he still retains his opinion that fiorin may be termed an *autumnal* grass with the strictest propriety, as it does not attain to its greatest perfection of crop till the end of July, when the perfection of the culmiferous grasses is past. And without pretending to deny the great excellence of fiorin in Ireland, he yet continues to doubt its vast superiority over many of the grasses which are cultivated in England, when crops produced from it on this side the Channel are put in competition.

Dr. Richardson, in answer to the second letter of Mr. Tanner, remarks, that the two subjects on which they differ in opinion, are, 1, The species of grass predominant in the famous Orcheston meadow. 2. The merits of the agrostis stolonifera, or fiorin, in Ireland. Referring, in the Memoir, to the Transactions of the Board of Agriculture, he notices that he had there expressed himself as to the prevailing grass of the Orcheston meadow being the agrostis stolonifera, as *highly probable*, speaking guardedly of his own opinion; and conceiving it possible, that the different and discordant decisions of botanists who have visited the meadow may have arisen from their investigating the panicles alone, he re-asserts what he had stated in the Memoir, that a more minute examination might produce a very different result, and that handfuls of the close sward might be found to consist almost entirely of fiorin. And the reason of the mistake he considers to be obvious, since any one wrapped up (to use his own expression) in the sexual system of Linnæus, would limit his speculations to *classification* and *nomenclature*, and shut his eyes against every thing but *sexual distinctions*. "My unfortunate stolones," says he, "unprovided with these botanical treasures, could not attract notice; and the Orcheston meadow, though its stolones have been celebrated for nearly two centuries, and their immense length stated, by many writers (particularly Ray) remains a disgrace to Botanical

Schools." Many quotations from botanical writers are then added, to shew, that the stolones in the Orcheston meadow, though unaccounted for, were not unnoticed. And unwilling to relinquish his position that fiorin is in reality the prevailing grass of this celebrated meadow, Dr. Richardson pursues his arguments and quotations to a length, which our limits preclude us from following. With regard to the second point, the vast productiveness of fiorin in Ireland, is again and again insisted upon, and reasonings and the results of experiments are detailed in support of the fact with disgusting repetition.

Mr. Tanner maintains, in a third letter, that you may fill the hand in the month of May with the growing grass of the Orcheston meadow, without finding a single stolo within the grasp, the whole consisting of poa trivialis, the culmi of which run the length of twenty feet and upwards, and no sooner begin to appear in the spring than they trail on the surface, and strike root at the joints, not beginning to take an erect form till the sun increases in power towards April; and that the second crop is equally free from the agrostis as the first. Premising that a vegetable may be very productive in the humid atmosphere of Dr. Richardson's residence in Ireland, he relates a limited experiment he had made in his garden with a grass which proved, in comparison with the fiorin sent to the Bath Society, to be the very same species, the result of which was, that the fiorin plat of two years old, when weighed in a wet and green state, yielded after the rate of twelve tons and nineteen hundred weight per acre; and that of one year old about eight tons twelve hundred weight to the acre, both grown on as rich black soil as can any where be met with, such as would be worth five pounds per acre, in Wiltshire, for horticultural purposes.

Dr. Richardson's third reply contains the result of several experiments on fiorin in Ireland, which are certainly very favourable as to the quantity of produce; he digresses, however, from the main question to discuss many *terms* used in the correspondence, without at last arriving at the certainty of definitions; and with this letter the correspondence closes in the volume of the Agricultural Magazine now under notice.

Observations.—The very high character which fiorin grass had obtained in Ireland, through the patronage and recommendation of Dr. Richardson, must naturally have attracted the attention of agriculturists in England; and accordingly some gentlemen of the Bath Agricultural Society proposed to give premiums for its cultivation; this, however, was opposed by other of the members, and among the opposers Mr. Tanner more particularly distinguished himself. The part which he took in the discussion led to the correspondence, which is the

subject of this article. And while we trace in every line the paternal fondness of Dr. Richardson for the reputation of the species of grass which he has brought into such public and general notice, and applaud the earnestness with which he supports the object of his protection, we cannot but receive his arguments with a recollection that his mind is impressed with strong partiality, and that his prejudices may in some points warp his better judgment. The proofs that fiorin is highly deserving of cultivation in Ireland, are too many and too respectable for us to presume to doubt; but we must at the same time allow that Mr. Tanner has (at least in our opinion) made good his position, that the luxuriant verdure of the Orcheston Meadow does in no way whatever arise from fiorin grass. Nor can we allow, as Dr. Richardson would contend, that all former botanists have mistaken the stalks *(culmina)* of the poa trivialis for the creepers *(stolones)* of the agrostis stolonifera. The resemblance between the panicles of the one grass and of the other (whenever the agrostis produces panicles) is certainly great, but we cannot suppose them to have been uniformly mistaken by botanists, from Ray to Mr. Tanner. The produce of fiorin in England has never, in any instance, reached the quantity it has obtained in Ireland; and we incline to the opinion, that its great luxuriance there is rather owing to local causes, yet undiscovered, than to any peculiar intrinsic principle. This is not to be collected from the letters before us; but some *useful*, and more *botanical*, knowledge is certainly contained in the correspondence of Mr. Tanner and Dr. Richardson.

On Fiorin Grass, Quitch Grass, &c. By Mr. WRIGHT, *of Exton, Rutlandshire.—Agricultural Magazine, No.* 63.

On Fiorin Hay. By an EARLY EXPERIMENTER.—*Ibid. No.* 64.

On a supposed Misrepresentation of Quitch Grass, and a Question on Fiorin Grass. By Mr. HOLDICH, *of Thorney. Ibid. No.* 65.

On Quitch, Fiorin, &c. in reply to Mr. HOLDICH.—*Ibid. No.* 66.

On Fiorin, the Orcheston Meadow, &c. By C. HALL, *near Blandford.—Ibid.*

OF these several articles it is only necessary to observe, that the writers are followers, at a very humble distance, of Dr. Richardson and Mr. Tanner, but yet may afford some amusement and information to those who interest themselves deeply in the *fiorin controversy*.

On a temporary Rick to secure Corn, &c. in wet Harvests, invented by WILLIAM JONES, *Esq. of Foxdown Hill, Somerset.—Agricultural Magazine, No.* 61.

THIS rick is formed by placing four gate-hurdles in the ground, in such a manner as to form a square of about eight feet each way. The two outer hurdles are driven far into the ground, and perpendicularly; the two interior are placed sloping, so as at the point of union to be rather higher than the outer hurdles; and stakes are then laid across the hurdles, lower by one bar on the outer hurdles than on the inner. On these stakes are placed the sheaves of wheat, or other corn, with the bottom part outermost, and the ears not quite, or but slightly touching each other; and as soon as they reach the top of the hurdles they are built in a circular form, the middle being open, where the ears scarcely meet. The ear part of the sheaf is to be constantly kept the highest, and when it approaches the level, elevation is to be gained by placing four sheaves round the opening, on which the ears of the next row are to be laid; and this is to be repeated as often as is necessary. When the rick is as high as is required, the sheaves are to be so placed as to form the roof in a conical, or sugar-loaf form, and the point will be protected by a sheaf placed bottom upward on the top, with the ears spread round the stack. The rick may be conveniently of such a size as to contain the produce of an acre or more. And in the same manner, it is said, that loose corn may be advantageously put together in wet harvests.

Observations.—The mode of stacking corn in a temporary way, here pointed out, will be found very useful in unfavourable weather, since the air will draw through the hurdles and up the hollow part of the rick, hardening the corn at the same time that it is preserved from the effect of rains. The plan seems very well calculated for the northern parts of the island.

On the Cultivation of Burnet and Clover. By a (DENGY HUNDRED) FARMER.—*Agricul. Mag. No.* 61.

THE writer states, that in the spring of 1810 he sowed a bushel of burnet seed per acre upon land in fine tilth and condition, and sown at the same time with black oats. The seed was well covered by a double harrowing, but vegetated slowly, though it afterwards came up a full plant, and carried a good appearance through the winter. He considers this plant to be of forward growth undoubtedly, but not of large produce,

even upon the best lands, and that no animal will eat it while any other grass is to be obtained, for he tried with every description of stock, and it was disrelished by all.

He thinks there is no doubt of the success of clover at all times upon well-cultivated lands, without any regard to frequency of repetition, though it is hazardous and uncertain upon foul land, or such as is tilled imperfectly.

Observations.—We agree with the opinion of this writer as to burnet, which only merits cultivation where no other green food can be obtained early in the spring; but his ideas on the cultivation of clover, without regard to repetition of crop, are at variance with the practice of the most intelligent farmers.

On Drilling Turnips. By RUSTICUS.—*Agricultural Mag. No.* 61.

IT is stated, that on a visit among a considerable number of farmers in Essex and Suffolk, the writer found them quite indifferent to drilling of turnips on sand and very light soils, where the horse-hoe is not absolutely necessary; they agreed that the horse-hoe was indispensibly necessary upon heavy lands, but discouraged the cultivation of turnips on such soils; the chief reason for drilling being the convenience of hoeing and weeding, but this might be applied equally to turnips when sown broad-cast.

Observations.—We conceive that *Rusticus* would have conveyed a more accurate idea of his knowledge of agriculture if he had designated himself *Urbanus*, for the residents in any other part of the country, than the work-room of a manufactory, would have known what is here so pompously communicated through a magazine.

On Spring Wheat. By an ESSEX CLOD-HOPPER.—*Agricul. Mag. No.* 61.

IT is remarked that spring wheat is but seldom cultivated, though it has been so frequently and so strongly recommended. In order to shew that it is not unworthy of notice as a profitable crop, it is stated that a Scotch farmer had, in 1810, a crop of red wheat drilled at ten inches and a half distance, which proved so thin in the end of April, that he intended to plough it up for oats; but recollecting Sir John Sinclair's recommendation of spring wheat, he drilled a bushel and half per Scotch

acre between the rows; and when the two crops came to maturity, the produce was more than double what it probably would have been, had the crop remained in its first state.

Observations.—The value of spring wheat does not seem to be duly appreciated by the generality of farmers; the more however it is known, the more generally will it be substituted for other crops of spring corn.

On *the Use of Fiorin Grass for thatching Cottages. By the Rev.* WM. RICHARDSON, *D.D.—Agricul. Mag. No.* 62.

THE Doctor states that he had received, from a gentlewoman of much respectability, a request that he would inform her whether fiorin grass, well dried, might not be advantageously employed in thatching cottages; and he speaks of the idea not being then suggested for the first time. And not being able to determine the question himself, he went to a neighbour who had made the experiment, and found upon enquiry, that the fiorin thatch had been tolerably staunch through the winter, but when vegetation recommenced, and stolones were produced, these served as conductors of the water, and the roof became leaky.

Observations.—If it had not been for the respectable names mentioned in this article, we should have suspected the old lady intended to *hoax* the Doctor about his favourite grass; but the enquiry appears to have been made with a real desire of information. Since, however, fiorin grass has been stated to be so valuable for every purpose, we should not be surprized if the learned Mr. Saunders, of hemp-seed notoriety, was to write to Inoy to enquire whether it might not be beneficially and economically applied to the use of winter sallads!!

On *Soap Ashes, as a Manure. By a* SALOPIAN.—*Agricul. Mag. No.* 62.

IT is related that the proprietor of a soap manufactory, in Shropshire, had a field of five or six acres, of a lightish loam, in bad condition: this he manured with soap ashes, three or four years ago, expecting to put it in good heart; but he was completely taken in, for it would bear nothing at all, being burnt up, and as barren as the desarts of Arabia: he afterwards took off the surface to the depth of five or six inches, and sowed it with wheat, which produced a tolerable crop.

Observations.—This experiment with soap ashes for a manure is not undeserving the attention of the public, especially since some interested individuals have so strongly recommended the use of the article in many of the London and provincial newspapers.

On cutting Wheat green, and on the Quality of English Wheat compared with the Continental. *By* C. M.—*Agricul. Mag. No.* 62.

THE proper time for cutting wheat having been long a disputed point among farmers, whether as soon as the kernel be fully formed and consolidated, although yet green in colour; or not until the brownness of the colour denotes the full maturity of the grain; the writer of this article marshals the arguments on both sides. For the former method the prevailing ones are—expedition and taking time by the forelock, that grand point in every concern of husbandry; since if grain want nothing more than it may acquire in the sheaf, and the weather invite, no risk ought to be incurred, since the interval of fine weather may be of short duration.—On the other side it is contended, that wheat will carry the semblance and colour of ripeness over perhaps a considerable portion, which, on examination will be found merely external, and confined to the chaff, while the kernel is not advanced beyond the milky state; and the weight of the ripe corn unavoidably lost during reaping will never equal that which is lost in the shrinking and drying of what is prematurely cut; since ripe corn will attract moisture, and acquire additional substance in the sheaf, and retain its natural colour; while that which is cut green will shrink and lose substance, and become thin and steely.

And it having been asked on what ground it is that foreign wheat invariably bears a higher price in the market than the best English, he observes, that forty years ago it was directly the reverse; but that forty years ago the English farmers did not cut their wheat till fully ripe.

Observations.—The circumstance of foreign wheat always obtaining the best prices in the market, ought to call the attention of our farmers at home to the state in which they cut their wheat. And if it arises from the cause here suggested (which we more than suspect), it is of importance that the practice of cutting wheat in a green state should be relinquished in future.

On heated Hay-Stacks. *By Mr.* JAMES BRIGHTLEY.—*Agricul. Mag. No.* 62.

On fired Hay-Stacks. *By* ———, *of Stoke Newington.*—*Ibid. No.* 62.

On the fired Hay-Stacks. *By* IMPARTIALIS —*Ibid. No.* 63.

THE observations contained in these articles are neither new nor deserving more particular notice; they were mostly suggested by the burning of Mr. Laycock's hay-stacks, at Islington, concerning which it was doubted whether they took fire from the natural heat, or whether they were destroyed by the malevolence of an incendiary.

On the late double Crop of Wheat in Wilts. *By* CULTIVATOR MIDDLESEXIENSIS.—*Agricul. Mag. No.* 63.

AN account having appeared in the newspapers of a crop of wheat springing from the stubble of the preceding year, this gentleman attributes the assertion to mistake, and contends that it was produced by the ripe corn shed the preceding harvest, which would manifest the same appearance in the spring as if it had actually sprung from the roots of the stubble of the preceding crop.

Observation.—We consider the suggestion here offered, as a reasonable and sufficient solution of what otherwise appears a difficulty in the regular progress of natural causes.

On the sea-shore Exposure of Corn. *By* MR. J. BRIGHTLEY. *Agricul. Mag. No.* 64.

MR. BRIGHTLEY states, that in his rambles in the Isle of Thanet, in 1812, he was astonished at the extent of the damage done to the corn crops by the wind; both wheat and beans lying about the land, in a number of places so thick that they might have been shovelled. At the same time he observed, that the lucerne in the island exceeded, in quantity of produce, that of any other part of England, and seemed to be entirely unaffected by the exposed situation of the country. From these circumstances he infers that it would be preferable to substitute grasses for corn in all greatly exposed situations.

Observation.—While we admit the accuracy of Mr. Brightley's observations, we can not agree with him in the inference

he draws. It would be painful to see the Isle of Thanet clothed only with artificial grass, instead of continuing, as it is at present, *the corn garden of England.*

On the Culture of Carrots. *By* A STAUNCH ADMIRER OF PRECEDENT.—*Agricul. Mag. No.* 64.

THE prevailing idea that carrots are deserving of field culture only in the districts, which have been accustomed to them, is opposed by the following fact:—The writer, who dates his communication from Botley, in Hampshire, a district where carrots are not at all cultivated, states, that he obtained from three hundred to six hundred bushels per acre, after a clean fallow, and at less expense than he could have obtained a crop of potatoes.

Observation.—There is no doubt but that carrots will succeed on most soils after a clean tilth; and when it is considered what a complete winter resource they are, of prime quality, not liable to be destroyed by severe weather, and an acceptable food to all kinds of cattle, and of great acreable produce, we cannot but be surprized that their cultivation should be so extremely limited. Their value, however, is duly appreciated in Suffolk and Surrey.

On blighted Wheat Seed; and on Spring Wheat. *By* CULTIVATOR MIDDLESEXIENSIS.—*Agricul. Mag. No* 64.

THIS article commences by noticing an experiment on blighted wheat for seed, made by a Mr. Crowther, of Gloucestershire, the result of which has been given to the public in a pamphlet by that gentleman, but remarks that the subject of that experiment was spring wheat. And though the result is allowed to be satisfactory and important, as far as it goes, as a well attested instance of the use of blighted corn for seed in a case of urgency; yet, as this result is in opposition to other previous experiments, the writer does not conceive it ought to be received as an axiom in Agriculture, or supercede the propriety of sowing better seed; and he thinks the success of Mr. Crowther should be considered rather as an exception than as a general rule of practise.

The advantages derived from crops of spring wheat are considered to be either much under valued, or but very partially known, otherwise it would become an object of general culture,

since farmers are always partial to a wheat crop, instead of being, as at present, only resorted to when the autumnal crop fails.

Observation.—Our readers will perhaps remember that the sowing blighted corn, instead of a superior sample, originated in a recommendation of Sir Joseph Banks, on the ground that the better seed would then be wholly appropriated to the supply of market; but, though a very satisfactory instance has been given of its success, we do not think the practice stands yet on a sufficient foundation of experiments for the farmer to rely on it, except in cases of urgency.

On *the most effectual method of destroying Couch, &c. By* O. S.—*Agricul. Mag. No.* 64.

AN instance has come within the knowledge of the writer, where the most diligent application of the usual methods for the destruction of couch grass had been made to no purpose; he gives a statement of the facts, and his reasons for thinking that a different mode might have been more effectual for the purpose. It is stated, that in the summer of 1810, there were forty acres (to all appearance) as clean and well made fallows as could be found, upon which six earths had been bestowed, and upwards of three pounds per week had been paid, for ten weeks, for couch picking only; the dry weather affording every opportunity for the destruction of the couch and rubbish, and the whole of the fallow on the seed earth being given, appeared in that state, that a drill of the narrowest rows might have worked with the greatest ease. It was all sown by the end of October, and landed up for the winter, and in the spring following the clover was harrowed in, and produced an abundant crop in both harvests, free from rubbish throughout the whole extent; and the spring corn, which succeeded the clover, also received a hand weeding: yet after this clean fallow, and this expensive hand-weeding, when the crop of spring corn was removed, the whole forty acres were a complete sweard of couch, knot-grass, and water-grass, such as would have burnt very well had it been pared. From the very foul state of these lands, after so good a fallow, and only two white crops, the writer was led to reflect on the evident inutility of a fallow to eradicate couch; and he accounts for the failure from an opinion, that during the two seasons of the wheat and clover crops so much time had been given to the couch and all the trailing tribe of grasses to recover from the severe treatment of the fallow, that they had increased and multiplied under the protection of the crop of spring corn: and he conludes that this mode of

cropping from a fallow does not tend to destroy, but to multiply the couch, as well that which was not brought up to the surface of the soil, as that which was left there by the weeders. He is also of opinion that the drill and horse-hoed crops offer the best prospect for eradicating this troublesome weed—namely, in the first place a good and sufficient fallow, in which the use of the extirpator between each ploughing is not neglected, and the rubbish collected and burnt; and the succeeding crops all drilled at sufficient intervals to admit of being hoed very completely. And with respect to the management of the land, in question, he thinks paring and burning to be the most effectual step for the destruction of the noxious weeds.

Observation.—We have given, comparatively, a very extended account of what is in the whole but a short article, because we think it affords many valuable hints, which may be advantageously seized upon by the practical agriculturist.

On the Bunias Orientalis, a new Cattle Food. By CLERICUS COLONUS.—*Agricultural Magazine, No. 57.*

This plant is said to be a native of Egypt and Syria. It forms a collection of leaves similar to those of chicory, but of the width of a palm and, probably, a foot or upwards in length; in taste, an agreeable and sub-astringent bitter, mucilaginous, juicy, and of considerable substance. All domestic animals appear to relish it, including rabbits, geese, and ducks: the hay made from it is substantial and good flavoured, but the difficulty of making it very considerable, on account of the leaves being so extremely succulent.

Observation.—On a vegetable so little known as the bunias orientalis we can be scarcely expected to offer many observations; it may, however, be beneficially cultivated in many instances after other crops have failed, as it may be sown any time in the summer season, but never with corn on account of its bulk. As the seed may be obtained from Mr. Gibbs, of Piccadilly, its merits will, probably, be soon more clearly ascertained.

RETROSPECT

OF

PHILOSOPHICAL, MECHANICAL, CHEMICAL AND AGRICULTURAL DISCOVERIES.

No. XXXIV.] *January, February, March, April.* [1813.

REVIEW OF SPECIFICATIONS OF PATENTS,

PUBLISHED IN THE REPERTORY OF ARTS.

Mr. SAMUEL BENTHAM'S *Patent for a new mode of excluding Water during the execution of under Water-works, applicable to the construction of Sea Walls, Wharfs, Piers, Docks, and Bridges. Dated March,* 1813.—*Repert. of Arts, No.* 123.

IN order to secure the purposes specified in his Patent, Mr. Bentham constructs a dam in the following manner:—

Either in one piece, of sufficient extent and suitable form, to enclose the whole of the spot from which the water is to be excluded, or in several separate pieces. But in both cases, in such manner, as that the junctures between the component parts of the entire dam, or of each separate portion of it, may be made water-tight by caulking, or otherwise, previously to its being put in its place, and in such manner as that it may be made to serve again for a similar purpose, without separation of its component parts.

He forms the lower part of the whole of this dam, if it be of one entire piece, or of each of the several portions of it, in such manner as shall be best adapted to penetrate the ground on which it is to be placed, to a sufficient depth, to prevent the passage of water under it.

For cases in which it is requisite for so much of the dam as is pressed into the ground, or somewhat greater portion, should remain there for the better protection of the foundation of the work, he forms it in such a manner as to be easily separated from the other part for this purpose.

Having formed the dam, whether entire or in parts, in some situation the most convenient for the purpose, he brings it with or without the assistance of boats, or other floating vessels, to the spot on which it is to stand; and then, by the application of weight, with or without the use of percussion, it is pressed into the ground to a sufficient depth. And in case of its being formed of separate parts, the junctures between these separate parts are to be closed up in some of the modes usually employed for such purposes.

When the dam has served its purpose in the situation in which it is first used, it may be removed to be in readiness to be employed again for a similar purpose, the lower part having been left behind or not, as circumstances may require.

With regard to the form and mode of combining together an entire dam, or a large portion of a dam, suitable to the different purposes in view, and under different circumstances, Mr. Bentham has given the following examples:—

Where the spot from which the water is to be excluded may be circular, as for example, where it may be required to erect a column of masonry to serve as the support of a bridge, the dam may be circular, exceeding in size the intended column of masonry, so much as to allow sufficient space for the workmen. This dam is formed of staves, as they may be called, of wood, which might be about nine inches thick at the bottom, and three inches thick at the top, connected together, in the inside, by rings of cast iron, and fastened in such a manner as to admit of the dam being separated into two parts, so as to allow of its being taken away when the work is completed. To the lower end is fixed a ring of cast iron, about two feet deep, about one inch thick at the top, and as thin as it can well be cast at the bottom, but strengthened with brackets about three feet asunder. This circular dam is calculated to float about seven feet out of water, that it may the more easily be brought over the spot where it is to be set on the ground; where, being adjusted as to its exact situation, platforms may be laid upon the interior rings, and weights laid upon them, whether the materials to be used for the column or other weights, so as to press the cutting edge of the cylinder into the ground; and when the edge shall have penetrated sufficiently to have become watertight in the ground, the interior water may be pumped out,

and the ground be prepared in any manner that may be thought proper, and the masonry work be proceeded with.

The column of masonry being completed, so far as that the dam is no longer wanted, the two halves of it may be unscrewed, or otherwise detached from each other, so that they may be removed without impediment, from the column within. The cutting edge of the iron may also be detached, and left in the ground if thought requisite. Or it may, together with the cylinder, be raised up out of the ground by means of screws, or other mechanical power applied, for instance, on the column itself, or otherwise. The parts may then be floated to a convenient place for the purpose of reconnecting them, and for adding a new cutting edge if the first has been left in the ground; and the dam may, as before, be employed for the construction of another column, and so on successively.

Where the spot, from which the water is to be excluded, may be of an oblong form, as, for example, when it may be required to erect some distinct mass of masonry, like that of the pier of a bridge, the mode of forming and managing the dam might be the same as in the preceding case, excepting as far as regards the supports, which would be requisite for a straight-sided dam, but which are unnecessary in regard to a circular one. Provision should be made, in this case, for detaching either one side of this dam from the rest, or all the four sides one from the other.

That the straight sides and ends of this dam may be enabled to resist the pressure of the external water, cross shores may be introduced. These shores, the upper ones particularly, may serve as beams or bearers to support stages, on which the materials for the pier may be deposited, and for other purposes subservient to the carrying on of the work. As the masonry is brought up from the bottom, these cross shores should be taken away, inserting previously, in lieu of them, as the work advances upwards, short shores from the sides and ends of the dam, and resting against the work itself.

When it may be required to exclude the water for the carrying on a pier or wall projected into water for a considerable length, the mode of forming and management of the dam might be as specified in regard to case the second, excepting, that after the first portion of wall shall have been formed, and the dam has been set down to exclude the water while carrying on the second portion of wall, one of the ends of the dam must be either altogether omitted, or have a vacancy left in it sufficient to receive a portion of the wall already formed, and to which it must be made to fit water-tight. The juncture of the dam

to the wall may be made in any of the modes in use for excluding water.

When it may be required to exclude the water for carrying on a wharf wall, or embankment, the side of the shore itself being supposed to serve as one of the boundaries of the dam, the interior side of the dam, as well as one end, as above specified, or even both ends would be omitted. The ends might be made tight, one against the wall itself, the other against the shore in any of the usual modes, and the longitudinal dam might be supported by struts from the ground within.

The dams that are above described have been supposed to be single; but in some cases, either in consequence of a less perfectly water-tight stratum of ground, or from other circumstances, it may be preferable to make them double. A double dam, like a single one, might be formed in one piece, so as to enclose the whole of the space, or to form two or more of the contiguous sides of the space out of which the water is to be excluded. But as it would be, generally, most expedient to construct, in one piece, a dam of such form and dimensions as should serve to form no more than one side of such an enclosure, or even a portion only of one side; when an entire side would be of an inconvenient length, Mr. Bentham proceeds, by a reference to accompanying plates, to describe a double dam suited to form one such portion of the requisite enclosure.

His plates exhibit a double dam of about 55 feet in length, about 30 feet high, and 12 feet broad, the structure of which should be made sufficiently strong to resist the pressure of the exterior water, acting on one side, while the water is altogether taken away from the other. It is evident that a dam of this construction is very conveniently adapted for being floated to the place at which it is designed to be used. To the bottom of this dam a cast iron frame is fixed, correspondiug in length and breadth to the bottom of the dam to which it is fixed, projecting from it downwards, and adapted in other respects to the penetration of the ground, as in the lower part of the single dam.

In the plates and figures which accompany his patent, Mr. Bentham shews the manner in which four such portions of a double dam may be set down, so as to include a quadrangular space for the purpose of constructing any detached work, as for example, the pier of a bridge. He also shews the manner in which three such double dams may be set down for the exclusion of the water, for the purpose of erecting a wall or pier projecting into the sea.

He also says that an embanking wall may be carried on under the protection of a double dam in the following manner:— the outer side of the dam being formed by a double dam, the same

as in the former cases, and one end being joined to a part of the wall already built, the other end may be joined, water-tight, against the shore, either completely, by a portion of a double dam, constructed as the others, but made shallower at the part next the shore, so as to suit its inclination; or, in part by such a double dam, and the remaining part in the usual manner; or, if the distance be small, the whole of this end may be formed in the usual manner.

The dams themselves may be made of wood, or of iron, cast or wrought, or of any other suitable material. And the double dams, being hollow like vessels, may be used as receptacles for materials, the erection of a steam-engine, lodgings for workmen, or for other purposes subservient to the carrying on of the work.

In the case of dams, formed in any of the manners above-mentioned, as in the case of dams formed as usual, clay or other soil may be applied to the outside of them whenever it may appear requisite.

Where the soil makes it necessary, the bottom of such double dam may be omitted, for the purpose of causing soil of any kind, whether inclosed in bags or not, or with a mixture of moss, sea-weed, straw, litter, or other fibrous matter, to be deposited between the outer and inner boundary of the double dam.

In order to make the juncture between the several portions of dams more easily water-tight, Mr. Bentham prepares a groove in both the surfaces of the dams that are to meet, when the exact line of juncture can be easily ascertained. If otherwise he continues the groove to the lower edge of the cast-iron, or other penetrating part of the dam. Into this groove either a tongue of wood may be inserted, in the way which is practised in coffer dams, or in some cases with better effect, some elastic or plastic matter, as oakum, moss, cut-straw, with or without a mixture of earthy matter, may be rammed down from the top to their lowest edge.

Observations. Mr. Bentham's patent has reference to objects which are connected with the greatest public utility in a commercial nation, and will, therefore, be examined with proportionate interest; we are inclined to think that this invention is calculated to secure the objects which it delineates, with greater expedition, and probably greater economy than the modes usually adopted in works of this extended and public nature; and we regret that a comparative statement, embracing the latter object, does not accompany the delineation of the invention, it being desirable to keep this principle in view, both when individuals or the public are called upon to relin-

quish old in favour of new plans. We fear, however, that this method of excluding the water can only be advantageously adopted in shallow streams, for the expense and hazard of using these dams in tide rivers or rapid currents would, we apprehend, be more than that of coffer dams as at present constructed, for when it is necessary to sink several feet below the bed of the river for the foundation of a pier, the enclosure must be so enormously large for the purpose of allowing a proper slope for the support of the sides of the excavation, as to put all ideas of estimate out of the question.

Mr. JOHN TAYLOR'S *Patent for a Machine and Rods for cutting, spreading, and preparing Wicks for Dip Candles, dated Jan.* 20, 1808.—*Repertory of Arts, No.* 125.

Mr. Taylor's invention consists in the use of rods, so constructed as to contain a double row of wicks, and of a machine for distributing, or spreading the wicks.

He forms a centre piece, of wood or metal, which turns on two pivots, resting in centres, in upright posts. The horizontal part is about two inches square; and in the middle of the two opposite sides, there is a groove half an inch deep and one-eighth of an inch wide. This groove is nearly the whole length of the centre piece, and serves as a guide for the shears or scissars, when cutting the wick. The arms are twenty-five inches long, one inch thick, and three inches broad. Each of these arms has a slit, half an inch wide down the middle, to a point within four inches of the centre, where the pins are fixed. The distance between the arms of the centre piece, is about forty one inches.

Two guages are formed, both their sides alike. They are made of wood, one inch and a half thick, and five or six inches broad, and covered, within four inches of each end, with flannel or soft leather. The two ends of the guage are two inches higher than the covered part, and the same breadth as the arms, and are so made as to receive and allow the ends of the rods to rest therein. On the outside of each end of the guage is a slip or tenon of wood made to fit exactly, and to slide in the slit of the arms of the centre piece, in which slit or tenon is a small thumb-screw, and as the arms are graduated the guage may be fixed by the screws to the greatest nicety, at any required distance from the centre, according to the length of the candles which are to be made.

A thin board is prepared, covered on one side only with thick flannel, which, when the wicks are wound on the rods, is placed on the guage, with the covered side to the wicks, between two

small blocks of wood, and is held fast in that situation by two small buttons fixed on the blocks. Four of these boards are used in order to hold the wicks fast during the time of their being cut; and, as the covered part is well rubbed with tallow, it serves, in conjunction with the covered part of the gauge, which must also be well rubbed with tallow, to wipe and smooth down the wicks as they are drawn out from betwixt the covered board and gauge.

The rods have a broad or flat side to the eye, with angular notches at equal distances on both edges, for the purpose of containing the wicks. These rods are about forty inches long, two inches broad, and half an inch thick, and may be made with any number of notches, according to the required thickness of the candles. The notches are about half an inch deep, and about the same width in the wider part. A small piece of thin iron or steel is fixed in the groove side of the centre piece, in the slit of which the ends of the yarn are fastened at the commencement of the work.

Having placed on the shelves as many balls of yarn as may be required, and having the gauges properly fixed in the centre piece, the covered part of which should be well rubbed with tallow, a rod is placed on each of the gauges. These rods are prevented from falling out, as the centre piece goes round by a small steel spring, which presses gently against each of their ends. Having collected the ends of the different clews of yarn together, they must be fastened by being slipt into the small piece of slit iron or steel. After which the centre-piece must be kept turning with one hand, while the other is guiding the threads of yarn into the notches progressively, till the rods are filled. The four covered boards are then placed one on each side of the gauges, and fastened by the buttons; the gauges and centre-piece are then held horizontally with a pair of shears or scissars, and, having one point resting in the groove, the wicks are cut from one end to the other; which being done the centre-piece is turned round, and the same process takes place on the other side. After this the centre-piece is fixed vertically, and the uppermost rod being held with both hands near the ends, is drawn out carefully and perpendicularly and placed on a stage. The centre-piece is then turned, and the other is taken out in the same manner, and the rods are prepared for dipping. The covered boards are then taken off, and the process continues as before. These boards, when not fixed on the gauges, rest upon two pegs in the rack-rail.

An iron screw goes through the upright post, in the end of which one of the pivots of the centre-piece runs. By means of this screw the centre-piece may be taken out of the frame at

pleasure. The frame may be made of any kind of wood, or part wood and part metal. The rod should be made of hard wood, and not liable to warp. The notches may be either over against each other, or at right angles. The Patentee prefers the latter, as the candles on the two rows are not so liable to stick to each other during the process of dipping. The rods should be made of different dimensions, and for thick candles the notches should be made longer. Rods containing two rows of wicks may also be made in a half circle or a triangular form, with a single row of notches on the convex side, or on one of the angles.

Mr. Taylor states that in his manner of cutting and spreading wicks there is a great saving of time, and that candles thus prepared having no twist in them, give a clearer light than with twisted wicks, and that they do not require snuffing so frequently.

Mr. JOHN SIMPSON'S *Patent for improvements in Lamps.—Dated July* 16, 1813.—*Repertory of Arts, No.* 126.

MR. SIMPSON constructs that part of the fountain-lamp called the reservoir by fixing the plate of a valve, which, when down, closes a hole in the diaphragm crossing the reservoir. This plate is fixed at the end of a lever moveable upon a centre, and closed by a spring; when not acted upon by a wire which is fixed to the other end of the lever, and communicates with the upper part of the lamp. An air-tight stopper, or screw-piece, is so fixed as, when down in its place, to press upon the upper end of the wire, and to keep the valve open; the effect of which is that the valve will be closed when the stopper is in its place. The diaphragm is useful, also, in allowing the air to ascend without impediment, which effect will not take place when the tube is small, and the valve apparatus placed at the top of it.

The apparatus for carrying the wick in lamps which have a current of air passing through, and by the flame, he constructs by making of iron, brass, or other suitable metal, the cylindrical tube, in which the female part of the screw for sliding up the wick-holder is formed. He indents the female part of the screw by hammering upon it a cylindrical tool, nearly of a size to fit the internal cavity of the tube, and having the female part of the screw accurately made thereon, and on which the tube must be placed in order to be hammered upon, and having the female part of the screw indented in it.

He also makes a male thread of considerable length, and so

formed as to fit into the female part by soldering a wire upon the concave surface of the carrying tube, to which the wick is usually fixed, instead of the small stud usually applied to that purpose. And upon the convex surface of the carrying tube he affixes a projecting piece, about half the length of the tube, instead of the small stud usually applied to this purpose. This projecting piece, when the wick holder is in motion, slides in a groove made in the outer tube of the fixed part of the lamp. Within this fixed tube, at the top, is also inserted a narrow rim of thin metal, for the purpose of confining the wick in its place. By the fixed part of the lamp, he means that part which, in all lamps of this kind, contains the oil for the immediate supply of the wick.

He farther connects a piece of a tube with the cylindrical tube, of such a size as nearly to fill the bore of the inner tube of the fixed part of the lamp, and of such a length as to pass down through that bore to the bottom of the fixed part. And to the lower part of this piece of tube he attaches the lower part of the apparatus of the lamp, which has heretofore been usually applied only to receive the spare oil. And by mooring the lower part round, when necessary, motion is given to the cylindrical tube upon which the wick-holder is placed; and by this means he raises and lowers the wick without the use of any piece at the top.

Those lamps to which his invention applies he constructs by placing two or more wires, or pieces of metal, immediately within and in contact, or nearly so, with the upper rim of the outer tube, through which the external current of air is allowed to pass, and having tails beneath for the purpose of communicating motion to it. It is the effect of these wires, to alter the direction of the external air, to reflect it inwards against the flame, and thus to render the flame more brilliant.

And, farther, when the tails are turned by the action of a circular piece added to the lamp, the wires themselves take different situations, and snuff the wick by passing closely over it. But in lamps which are made without requiring the operation of snuffing, the Patentee fixes an interior ring of metal within the tube instead of the upper parts of the wires; and in this case he omits the wires altogether, and the piece for mooring them. And, in conjunction with the wires or ring, he applies an horizontal plate of metal, supported in the centre of the lamp at a small distance above the bottom of the flame, and of the same diameter as the interior air tube, or nearly so. And he states that the wires, or ring, and plate, greatly increase the brilliancy of the flame; and allow the use and consumption of common, or impure oil, if preferred.

Mr. W. H. HART'S *Patent for a Machine for Cropping or Shearing Woollen or other Cloths, and Fur for Peltry. Dated March* 24, 1812.—*Repertory of Arts, No.* 124.

MR. HART'S invention consists in causing the cloth to pass regularly between some smooth surface and a fixed cutting plate, so that the nap may be cut off by means of a number of light blades moving upwards and downwards alternately, and pressing against the edge of the fixed cutter by gentle but active springs, producing the effect of hand-shears.

A frame is constructed about three feet high, three feet wide from front to rear, and in length adapted to the width of the cloth which is to be shorn. On the top pieces of this frame, near the front of the machine, are placed the feet of two other pieces, each of which is about two inches thick, three inches broad, and twenty-eight inches long, declining backwards at any angle which may be found the most convenient from experience, and supported firmly by braces inserted near their tops, and resting on the top pieces near the back parts of the frame. These pieces make the plan of movement for that portion of the machinery which may be considered the principle of the improvement. At the top of each of the two pieces above described, is fastened by a bolt, or otherwise, a piece of wood about two inches thick, three inches wide, and seven inches long. In the lower end of which is a mortice five-eights of an inch wide, extending three inches from the end, each of which mortices receives a tenon of another piece about eighteen inches long, and of the same scantling as the piece of wood mentioned, through the centre of each of which mortices and tenons there is a hole about three-quarters of an inch in diameter, to receive a rod of iron which is formed into a double crank, and by means of arms connected with it moves the jack, alternately, up and down about an inch. At the lower end of the pieces (stated as above to be eighteen inches long) is fastened a piece of timber about three inches square, with a rebate about half an inch deep and two inches wide. This piece projects over the right hand of the machine about six inches, and being thus connected is raised up or let down at pleasure, turning on the double crank, which acts as a spindle to the hinge made by the mortices and tenons. In each of the above described pieces, on the sides facing each other, is a slit or groove to receive the two ends of the board which is called the jack; the upper side or part which is most elevated is made the thickest. This board, which is connected with the double crank by means of two arms, is caused to slide up and down, or backward and for-

ward, about an inch in the grooves, by each revolution of the double crank. On that side of the head which faces the jack, and in the rebate, are fastened a number of light blades, from ten to twenty, in the length of three feet, as may be found best. These blades are made of thin steel plates, of good temper, about three quarters of an inch wide and ten inches long, screwed or rivetted to the head at one end. Near the other end of which a rod or iron is to be attached, by being inserted through a hole or eye resembling the shank of a button, so that the wire plays loosely. This wire being about five inches long, and bent at the other end at right angles, is inserted through a hole in the jack, so that when the jack is in motion the blades are moved up and down, and press upon the cutting plate by means of springs. These blades, instead of being made fast at one end to the head, may be of some convenient form, and attached immediately to the jack so as to move with it, unconnected with any other part, and governed by springs fixed also to the jack. On the upper part of the top pieces is a post to support a wooden cylinder about two inches in diameter, in which is fixed a number of short sharp points; this is called the prickly roller, and serves to keep the cloth even. Horizontally with this prickly roller, and immediately under the light blades, is a cylinder of iron, about one inch in diameter, called the shearing cylinder, on which rests the cutting plate or blade, which should be a thin plate of tempered steel, two or three inches wide, and fixed upon a bar of wood to keep it firm. This cutting plate is declined from the plane of movement at an angle of about ten degrees, and the light blades are kept close to the edge of this plate by means of the gentle but active springs already mentioned, and which may be made of common iron wire of the same length as the blades, one end turned down at right angles and driven into the head, and the other forked and bent a little, so as to rest upon the back of the blade or shank. Each of these springs is governed by a screw which passes through the projecting part of the head, and causes the spring to act more or less upon the light blades. The proper movements of the machine are effected by a bar or shaft of iron or wood passing through the centre of the frame, and made to turn on the under side of the top pieces. On the right hand end of this shaft is a wheel or pulley three feet in diameter, and on the same end of the double crank is placed a corresponding pulley of four inches in diameter. These being connected by a strap or band, one revolution of the large pulley gives the double crank nine, and, consequently, the light blades are moved up and down over the edge of the

cutting blades nine times. The diameter of these pullies may be varied at discretion.

On the outer side of the shaft is fixed a pulley four inches in diameter, and on the end of the shearing cylinder another pulley twelve inches in diameter, and, also, a smaller pulley three inches in diameter. And on the left hand of the prickly roller is placed a corresponding pulley thirteen inches and a half in diameter.

Thus three revolutions of the main shaft will move the surface of the prickly roller and occasion the cloth to advance one inch; and during the same space of time it will cause the light blades to move up and down over the edge of the cutting plate twenty-seven times: and as each blade laps half way on the movement of the one before it on the cutting plate, fifty-four clips will take place on every inch of cloth passing under the cutters. The cloth is kept from slipping on the prickly roller by means of a small bar or roller which is placed directly underneath it, and the nap of the cloth is raised by a brush made to operate on its surface, whilst passing from the prickly roller to the shearing cylinder, which turns with the same velocity as the main shaft by means of corresponding pullies; which is the case also with the feeding roller.

Instead of the shearing cylinder a gauge blade may be used, consisting of a plate of iron or wood, the side, or part of which, next the edge of the cutting plate, and on which the edge rests, being straight, and a little rounded or bent for the cloth to pass over. And for the purpose of securing the lists of broad cloths from being shorn, the gauge blade, for the distance of, perhaps, eight inches on each side of the machine where the lists must pass, may be made to consist of narrow pieces or slips screwed or riveted fast at their hinder part to the bar of wood on which the gauge blade is fastened, and their forward ends coming in contact with the edge of the cutter, and corresponding in a straight line and rounded surface with the gauge-blade in general; the object of which is that as the cloth passes over the gauge blade, and under the cutter's edge, these slips being of a spring temper may yield to the thickness of the lists; and a thin plate being attached to the under side of the cutting-blade, one at each end, so as to slide easily sideways; and being governed by little stems extending from the edge a few inches forwards, they may be kept constantly over the lists in such a manner as to cover them and prevent them from being shorn, while the cloth adjoining the lists will be forced by the spring slips into close contact with the cutter and be duly shorn.

The cloth being folded regularly may then be laid within the body of the frame, on the floor or on a grate or basket near the back part of the machine. One end may be carried on the prickly roller, and then forward over the shearing cylinder or gauge-blade, and under the shearing cylinder, and over the feeding roller, which is caused to revolve much faster than the prickly roller, and tends to draw forth the cloth more rapidly than the prickly roller will suffer it to advance. But when every part of the cloth is thus drawn straight under the cutter it will slip on the feeding roller without injury.

The general form and proportions of this machinery may be varied according to circumstances. The cutting-blade must have a keen edge formed, by being levelled like the under blade of a pair of croppers or common clothier's shears, and the edge of the light blades which press on it must be rounded or blunted, resembling the upper edge of such shears.

Mr. B. Milne's *Patent for a double Bell and Gun Alarm. Dated October* 1, 1810.—*Repertory of Arts, &c. No.* 124.

Mr. Milne describes his invention by reference to a drawing, which represents a box, in which are two doors, thrown open by springs when the alarm goes off, a blunderbuss, a steel spring, and two bells, an upright frame of cast iron, to which the long lever, trigger, and stamper are screwed, an iron stamper, which, on falling, causes the gun and bells to go off, and the doors to be thrown open. The trigger supports the stamper; the bells are hooked on a hole in the side of the stamper near the brass knob; the trigger has a smaller end, by which the other end is raised to allow the end of the long lever to pass under it. The long lever supports the trigger, stamper, and bells; and small lines of whip-cord or wire are fastened to the lower extremity of it, by which the alarm is discharged. A brass knob is fixed in the middle of the stamper, by which it is raised to the top of the box. A small iron bolt is placed near the bottom of the long lever; and when this bolt is put up to the cast-iron frame the long lever will be secured in its place, and the alarm cannot go off. The stamper when it falls draws the gun trigger, and also the bolt which is fixed on the front of the box. A trigger wire is attached to the blunderbuss, and there is a steel spring behind the upright cast-iron frame: when this spring is put down tight to the butt end of the gun, the recoil will be stopt on the discharge of the gun. A small metallic pan is placed on the floor of the box in order to catch gunpowder; and the plates on the back and top are used to

prevent the possibility of fire. A lock is placed on the left hand door to secure the whole from wet or molestation; and small lines of pack-thread are connected with the buttons on the ends of the box, by which the alarm is discharged. They are fastened to doors and windows, conducted across passages, garden walks, and areas, &c. If left rather slack a person crossing them will not feel the touch till the alarm be gone off. Cast-iron clogs are formed to be laid upon the ground, on tables, chairs, or on any convenient place, to let down to the bottom of fish-ponds, &c. Iron loops are fixed in them with a small nich, on which to hook the pack-thread line, and then it may be conducted in various ways to windows, doors, &c.

Mr. J. L. DRAKE's *Patent for preparing the various sorts of Isinglass from river and marine Fish. Dated April* 8, 1812. *Repertory of Arts, &c. No.* 123.

THE mode of collecting the membranes of fishes that will yield a substance resembling isinglass is thus described :—

The fish must be slit down the middle, the intestines and sounds taken out and thoroughly cleansed. The head is also to be slit open and all the white skin of the palate collected; the maw well scraped till nothing but a pure skin remains, and the ovarium, and, in short, all the membranes or thin skin within the body of the fish equally answer the purpose of the Patentee. All these portions of skin, after thorough cleansing in cold water, are to be hung up to dry a little, then dipped in warm (but not boiling) water to take off the fishy smell and taste, and then cut into the different forms of common isinglass, such as long staple, short staple, &c. and dried by the sun or stoved, and are then fit for use. To make the cake isinglass the cuttings and the other parts are to be gently warmed till they cohere.

Observation.—This process is so simple and obvious as hardly to come within the definition of an invention. If our own cod and other fish will really yield a pure membranous jelly, as free from fishy taste and smell as the fine Russian isinglass, it is truly surprising that we should so long have set such an exorbitant value on this foreign product. During the late rupture with Russia, the ingenious Mr. Murdock, of Soho, Birmingham, pointed out to the brewers of the metropolis a mode of refining their beer by immersion therein of the skins of sole fish, which was found completely to answer the purpose of fine Russian isinglass, and for which hint they liberally rewarded him. The refining of coffee by this method has been long practised in many families.

Mr. F. MATTHEWS' *Patent for an Improvement in the Manufacturing of Yeast. Dated March* 5, 1812. *Repertory of Arts, No.* 130.

THE object of this very valuable process is to concentrate a dry yeast by a gradual pressure, carried to such an extent as totally to separate all the adhering moisture, and to reduce it to a dry powder, in which state it will keep for an indefinite length of time without losing its valuable qualities. The yeast, as it comes from the brewers, is pumped into bags made of stout worsted serge, which, when nearly full, are tied with cord and then placed under a strong lever press (the construction of which is particularly described), and there gradually subjected to a very strong pressure. The beer that runs from the yeast is collected carefully and returned to the brewer. After the yeast has been pressed to the utmost it is the consistence of flour, and is then taken out of the bags and spread thinly over canvas frames in a drying house stoved by hot iron plates till it is perfectly dry, when it is sifted and the fine white powdered yeast is packed in casks for sale. This powder, when wanted for use, requires only to be dissolved in lukewarm wort, and is then fit for every purpose for which yeast can be required. If kept dry it will preserve its properties uninjured in any climate, and for an indefinite length of time.

Mr. HARDACRE'S *Patent for a Composition to prevent, to a very extensive degree, the effects of Friction.— Repertory of Arts, &c. No.* 130.

A very few words will describe this Patent. The composition is merely one part of plumbago or black lead mixed with four parts of any kind of fat or grease. This is to be used in any kind of machinery to lubricate the parts exposed to friction.

Observation.—We may observe that the use of plumbago in preventing friction has been known for so many years, that we are totally unable to discover in what consists the Patentee's supposed discovery. We have, however, reason to believe that Mr. Hardacre will be well rewarded for the method he has adopted, of calling the public attention to the use of plumbago for the annihilation of friction.

Messrs. DICKINSON'S *and* MAUDSLAYS *Patent for a Process for sweetening Water and other Liquids. Dated Feb.* 1812.—*Repertory of Arts, No.* 129.

THE process consists simply in forcing a stream or streams of air through the foul or tainted water intended to be rendered sweet, and the process is particularly applicable to the purifying of water on-board ship which has become tainted and stinking in the water casks. The Patentee then proceed to state that "having mentioned the nature of our process, no competent mechanist can be at a loss to adapt means to the end proposed. The means which we have found best for this purpose are either bellows or a pump. If bellows be employed, a tube or nose made of leather, or any similar contrivance. will be found a convenient appendage, fastened to the nozzle of the bellows, for conveying the air into the water cask, and it will be found convenient to attach to the end intended to discharge the air a piece of tube, made of iron or copper, and perforated with small holes, to divide the air into numerous small streams, that the surface of the water brought into contract with the air may be the greater."

"If a pump be employed, which we prefer, it should be furnished with a similar nose or pipe, and the valves must be so disposed that the pump on being worked may at each stroke take in a charge of air, and force it to pass through the water intended to be purified. In either case the tube that discharges the air into the water should pass into it deep enough to reach the bottom of the cask, and the effect will be, that the offensive gas held in solution in the water (and which on board ship is generally hydrogen derived from the decomposition of a portion of the water, and holding different substances in solution derived from the decomposition of the wood) will, by continuing the process, be in a short time expelled from the water; after which the water should be left at rest for a little time, to allow its insoluble impurities to subside."

Mr. J. ROBERT'S *Patent for concentrating such parts of Malt and Hops as are requisite in making Ale, Beer, and Porter. Dated Feb.* 20, 1813.—*Repertory of Arts, No.* 133.

THE Patentee's processes may be described in a few words. Common wort, or infusion of malt, boiled down and evaporated to the consistence of treacle, forms his concentrated malt essence, and wort mixed with hops and boiled down to the same consistence forms his concentrated malt and hop essence.

There is no doubt that essence of malt contains in a condensed state the saccharine matter of a large portion of the grain, and that extract of hops is a very strong concentrated bitter. Both these preparations were as well known as posible, and the solid objections to their use in the common processes of brewing are the expense attending the previous evaporation of the respective infusions and the material injury to the colour, flavours, and aromatic quality which is produced by exposing these liquors for a length of time to the joint operation of heat and air, in the process of boiling down.

Mr. J. SUTHERLAND'S *Patent for an improvement in the construction of Copper Stills and intermediate Condensers. Dated July* 16, 1812.— *Repertory of Arts No.* 132.

THE invention consists in placing a closed vessel called here a condenser, between the still and worm of an ordinary distilling apparatus. Though the condenser passes a close cylinder which is an expansion or continuation of the beak of the still-head and leads to the beginning of the worm. This cylinder conveys the vapour from the still to the worm. The remainder of the condenser is filled with liquor intended for the second distillation, and during the first process it becomes considerably heated by the heat of the steam passing through the cylinder which it surrounds, and is therefore ready heated when it is wanted for filling the still. As some spirit also arises from the liquor of the condenser during this previous heating, this is collected by a separate head and worm which therefore in fact converts the condenser into a still-body but heated by the steam from the cylinder, instead of by a common furnace.

Observations.—The idea of making the heat given out by any portion of distilled vapour serve to raise the temperature of the next required charge for the still or for the further rectification of the first runnings, has often, we believe, been acted upon with advantage. The apparatus of the Patentee appears to be adequate to the intended purpose and convenient to use. The whole arrangement cannot be understood without a plate.

Messrs. HUBBALL *and* KING'S *Patent for a method of ornamenting articles of Paper, Wood, metallic Substance, Leather, Oil-cloth, &c. Dated Aug.* 1812.—*Repert. of Arts, No.* 133.

The article being first painted and japanned in the usual way, it is covered with gilders size or any similar glutinous article, and when almost dry the pattern of the ornaments cut out on paper or parchment and stuck on. The parts not covered with the pattern are then rubbed with a finely powdered iron ore and the whole is then finished with copal varnish polished with pumice and rotten stone in the usual manner.

Mr. HOWARD'S *Patent for a process for preparing and refining Sugar. Dated Oct.* 31, 1812.—*Repertory of Arts, No.* 135.

The two principles upon which Mr. Howard has founded his new method of refining sugar are the following, *viz.*

1. That water disolves the most uncrystallizable in preference to the crystallizable part of sugar.

2. That no solution of sugar can be exposed to its boiling temperature during the time requisite to evaporate it down to its crystallizing point, without material injury both to its colour and crystallizing power.

From the first mentioned principle it may be inferred that when raw sugar (or any other mixture of more and less crystallizable sugar) is wetted with so much water as will only dissolve a portion of it, that portion will be chiefly the impure or uncrystallizable part, and consequently the remainder will be left in a purer state. Also when impure sugar is moistened with a solution of pure sugar, the purer sugar will be separated and the impure portion will be dissolved in its stead. Hence when a little impure or uncrystallizable sugar is diffused through a solid loaf of crystallized sugar, if a solution of pure sugar is spread on the surface, the liquid in gradually percolating through the mass will dissolve the impure portion and carry it down to the bottom of the loaf leaving within it an equivalent portion of pure sugar separated from the water which held it in solution.

On the second principle here assumed, namely the injury done to the quality of sugar by long boiling it at a high temperature, the Patentee adopts the plan of evaporation by steam heat, which never rises to an injurious degree.

We shall now describe very shortly the outlines of Mr. Howard's process.

The first part is the following. Raw or muscovado sugar is well mixed up with a little water so as to bring it to the consistence of mortar (or a *magma* in chemical language) and this is then heated in a steam-bath to about 200 degrees, and transferred while hot to common earthen sugar moulds, and when cold the stopper of the moulds is withdrawn that the melasses may drain out. The upper surface of the lump is then pared down till the sugar presents an uniform appearance, and the sugar so pared off is again mixed with water to the consistence of a magma and replaced on the surface of the loaf from which it was pared off, or (what will generally happen in a regular course of manufacture) instead of the identical parings from each loaf a magma of equal fineness from former operations is employed. When this magma is moderately dry by the water percolating from it through the body of the loaf, a cold saturated solution of fine sugar in water is poured on its surface about half an inch deep by the intervention of a float, or else the last added magma (which is now considerably pure) is again pared off and remixed with water to a thinner consistency than before and again spread on the surface of the loaf. This purification of the loaf by solutions of purer sugar spread on its surface is repeated a number of times till it has gained the requisite degree of fineness; and in this process (which corresponds with claying in the common method) the more open grained the sugar turns out and the finer is the solution of sugar required for the purifying operation. The fit time for terminating this first set of operations is found by examining the colour of the melasses dripping out at the bottom. It is better to cool the loaf to about 60. degrees every time that a fresh liquid magma or solution is poured on the surface of the loaf, and again to warm it to about 80. or 90. degrees after the surface of the loaf becomes dry. Sometimes this surface becomes uniformly glazed over so as to prevent the escape of air from the interior of the loaf, and materially to hinder the percolation, in which case the surface must be broken up by some convenient instrument.

This first process being terminated, the loaves are knocked out from the moulds, the bottoms, in which the remaining melasses have settled, are separated from the rest and treated subsequently as raw sugar, and the purer part of the loaves is thrown into about a fifth more than its own weight of boiling water where it disolves, leaving behind the dirt and impurities originally contained in the raw sugar. The clear solution of sugar is then fit to be further refined by the use of the Patentee's finings which are of two sorts: the first or *ordinary fining* is prepared by dissolving alum in about 16 parts of hot

water, adding just so much whiting as will cause the solution to effervesce and neutralize the excess of acid, then adding so much slacked lime and water boiled to the consistence of curd as will decompose the sulphate of alumine and leave some excess of lime, and drawing off from this mixture all the liquid that adheres to it, leaving a solid mass which is the finings.

The second finings are prepared by disolving alum, neutralizing it by whiting, then decomposing it by caustic soda and collecting the alumine thus separated.

The solution of sugar, already much purified by the previous operations, is then mixed with the ordinary finings, afterwards allowed to remain at rest for some hours, and the clear supernatant syrup is then boiled down, to the crystallizing point, stirred with paddles in the usual manner when cooling to cause it to granulate, and then transfered to moulds where it forms loaves or lumps.

If these loaves are not fine enough they are further purified with the second finings, which are pure alumine and again re-made into loaves.

With regard to the temperature at which these different operations are carried on, the Patentee much prefers a heat below that of boiling water, which is best secured by the application of a steam-bath, but he does not consider this as essential to the success of the other parts of his invention.

Observations.—The idea of purifying sugar by the percolation of a solution of sugar already pure which is to deposit the pure sugar and take up the melasses in its passage through the loaf, is exactly the same as that of Mr. Constant's patent mentioned in our last number. Mr. Howard's plan is quite original, we believe, in bringing the raw sugar to a considerable degree of purity by mere percolation before the whole has been at all dissolved.

With regard to the use of a steam-bath and a comparatively low temperature, it does not appear that this has actually been put into practice, and it must be very doubtful (till the experiment has been fully tried) whether the loss of time in slow evaporation will not counterbalance all the advantage to be derived from keeping down the temperature in preventing the deterioration of the syrups.

Mr. THOMSON'S *Patent for a Method of producing Patterns on Cotton or Linen Cloth previously dyed Turkey Red. Dated March* 3, 1813.—*Repertory of Arts, No.* 136.

The following observations will enable the reader immediately to enter into the leading idea of this very ingenious and simple improvement in the application of agents which have long been familiar to the calico-printer.

The oxymuriatic acid is well known to be a most powerful discharger of all vegetable colouring matter, but it is now very commonly combined with lime or some other base, by which its operation is rendered more manageable. The affinity which this acid possesses for lime and the other bases is much weaker than that of most other acids for the same bases. Consequently if any other acid is printed on any portion of coloured cloth, and if this afterwards comes in contact with an oxymuriate (that of lime for example), the printed acid immediately decomposes that portion of the oxymuriate of lime which reaches it, unites with the lime, and sets free the oxymuriatic acid, which last being now brought to a state of increased activity by quitting its combination with the lime, acts with energy on the colouring matter in contact with it and readily destroys it, whilst all the other parts of the coloured cloth that have not been imprinted with the stronger acid remain exposed only to the weaker action of the undecomposed oxymuriate of lime. Therefore, in a cloth already dyed with a very fast colour, such as the Turkey red, the strength of the oxymuriate of lime may be so modified and the time of exposure so limited, that the general body of colour will not be injured, whilst the pattern spots on which the stronger acid mordant is previously imprinted, have time to become completely bleached by the increased activity of the oxymuriatic acid on these particular spots. It is on this ingenious mode of regulating the action of this powerful discharge of colour, that the process of the Patentee is founded.

The Patentee enumerates as mordants to be imprinted on the pattern spots almost every acid or other substance that has a stronger affinity with the lime, magnesia, barytes, or strontian of the oxymuriates of these earths than the oxymuriate acid itself has, but he gives the two following mordants as most approved of by his experience.

The first of these is made by taking a gallon of good vinegar or rectified pyroligenous acid, thickening it with starch in the way practised by calico-printers, and when boiling hot stirring in five pounds of crystalized tartareous acid. The second mordant is composed of one gallon of strong concentrated lime-juice (or one gallon of water holding in solution two pounds

and a half of crystallized citric acid) thickened by starch and then incorporated by stirring with two pounds of the acid sulphate of potash.

Where the stronger mineral acids, such as the sulphuric nitric or muriatic are employed, it is safer for the texture of the cloth previously to combine them to partial saturation with some base (potash in the example before us), provided the affinity of the acid for this base be not equal to that of the same acid for the base with which the oxymuriate acid to be subsequently applied is united. Or at least, the compound affinities of all the substances employed both for the mordant and the oxymuriate should be such, that the acid of the mordant will not be prevented from decomposing the oxymuriate as soon as they come in contact, so that the oxymuriate acid may be presented to the red colouring matter of the cloth at the moment of its disengagement from the base with which it previously combined.

The mordant, thus prepared and thickened with starch, is printed, stamped, or pencilled on the red cloth in the usual manner of producing patterns. When the mordant is dry the cloth is stretched on a dipping frame, so that no two folds can touch each other. The frame is then plunged into a stone vat containing a solution of oxymuriate of lime of from 1030 to 1050 specific gravity (water being 1000), and kept gently in motion for five or ten minutes in the liquor (not longer) after which it is thoroughly rinsed in cold water and finally cleansed by washing, branning, or soaping, in the usual manner. If the colour is found to be not perfectly discharged from the pattern parts, the cloth is again immersed in hot water containing a small portion of the oxymuriate of lime.

NATURAL PHILOSOPHY, ARTS, MANUFACTURES, AND CHEMISTRY.

Observations on the Measurement of Three Degrees of the Meridian, conducted in England by Lieut. Col. MUDGE. *By* DON JOSEPH RODRIGUEZ. *Communicated by* JOSEPH DE MENDOZA RIOS, *Esq. F.R.S.—Phil. Tran. Part* II. 1812.

These observations are prefaced by a reference to the different attempts which have been made by ancient and modern astronomers to ascertain the figure of the earth.

Among modern astronomers Newton and Huygens were the first that engaged in the consideration of this subject, and who reduced to the known laws of mechanics, the principles on which the figure of the earth should be determined. They demonstrated that the rotary motion would occasion differences in the force of gravity in different latitudes, and consequently, that parts of the earth in the neighbourhood of the equator would be more elevated than those near the poles.

The hypothesis which presented itself to their minds was, that the earth was throughout composed of the same kind of matter, and its surface that of a spheroid generated by revolution upon its axis. This hypothesis was adopted by Sir Isaac Newton only as an approximation to the truth; but it is a fact, perfectly consistent with the equilibrium to which particles, in a state of tardy fluidity, would arrive in a short time after their present motion was impressed, and the eccentricity derived from this hypothesis is at least not very remote from that which actually obtains in the present state of consistence and stability which the earth has since acquired.

But the homogeneity of the matter, of which the earth consists, is at variance with all geological observations, which prove evidently that the exterior crust is formed of an immense mas of heterogeneous matters, varying in density from each other. And upon a supposition of a state of fluidity of the whole, it would follow, that the strata would successively increase in density from the surface towards the centre, that the more dense would accordingly be subjected to loss of centrifugal force, and consequently, that the spheroidical form, resulting from this cause, would be less eccentric, than would arise from a state of perfect homogeneity.

The most simple as well as the most effectual means of verifying the hypothesis respecting the figure of the earth, is to measure in the two hemispheres several arcs of its meridian in different latitudes, at some distance from each other. On this subject, the Academy of Sciences at Paris set the example, and not only commenced but carried into execution, those parts of the plan which were most difficult and most decisive.

The results of the first measurements, made of different arcs on the meridian of different parts of the world, were found to be perfectly conformable to the expectation which had been entertained by Newton and Huygens; and also with experiments made on the vibration of the pendulum in different latitudes, and they left no doubt that the earth was, in fact, flattened at the poles.

These results did not, however, correspond with sufficient accuracy for ascertaining with precision the degree of eccen-

tricity, or even the general dimensions of the earth, and this might naturally be supposed in consequence of the necessary imperfection of the means which were at that time employed in those operations, and the great difficulties of the undertaking.

For the purpose of making a nearer approximation to the true dimensions of the earth, and of verifying former measurements, it is necessary, in some instances, to repeat them, and, also, to make others in different situations, the improvement of which may be expected in proportion to the progress which is made in the means of perfecting the several departments of science.

At the commencement of the French revolution men of science took advantage of the general impulse which the human mind received in favour of every species of innovation, and they proposed to make a new measurement of an arc of the meridian in France, for the purpose of establishing a new system of weights and measures which should be permanent, as being founded on the nature of things.

A commission, composed of some of the most distinguished members of the Academy of Sciences, was charged to form the plan of these operations, which were to serve as the basis of the new system. They invented new instruments, new methods, new formulæ, and, in short, almost the whole of this important undertaking consisted of something new in science.

Two celebrated astronomers, Delambre and Mechain, were engaged to perform the astronomical and geodetical observations, and these they continued as far as Barcelona, in Spain. The details of their operations, observations, and calculations, were subsequently examined by a committee of men of science, many of whom were foreigners collected at Paris, who confirmed their results, and by the sanction of such an union of talents gave a degree of credit and authenticity to their conclusions which could scarcely be acquired by other means.

Since that time, in the year 1806, Messrs. Biot and Arago, members of the National Institute, were sent into Spain for the express purpose of carrying on the same course of operations from Barcelona to Formentera, the southernmost of the Balearic Islands. Fortunately this last undertaking, which forms a most satisfactory supplement to the former, was completed by the month of May, 1808, at a period when political circumstances would not admit of any further operations, as a means of verifying the results by measuring a base which should be independent of those formerly obtained in France. M. Rodriguez farther states, that, in the year 1801, the Swedish Academy of Sciences, encouraged by the success of the operations conducted in France, sent also three of its members into Lap-

land, to verify their former measurement taken in 1736, by new methods, and by the use of new implements, similar to those which had been recently used in France, and of which the National Institute made a present to the Swedish Academy. The results of this new undertaking, which terminated in 1803, were drawn up by M. Svanberg, and were found to confirm, in a remarkable manner, the general results of those which had preceded, and gave very nearly the same proportion for the eccentricity and other dimensions of the globe. There would not, therefore, have remained the smallest doubt that the figure of the earth is flattened at the poles, had there not been a fourth measurement performed in England, at the same time as that which was undertaken in Lapland, the results of which were entirely the reverse.

This measurement was undertaken by Lieutenant-Colonel Mudge, with instruments of the most perfect construction that had ever yet been finished by any artist, contrived and executed for that express purpose by the celebrated Ramsden. The details of the observations and other operations of Col. Mudge are to be seen in the volume of the Philosophical Transactions for the year 1803. The beauty and perfection of the instruments, as well as the scrupulous care bestowed on every part of the service by that skilful observer, were admirable. Bengal lights were employed on this occasion as objects at the several stations, and their position appears to have been determined with the utmost precision by the Theodolite of Ramsden. Accordingly the geodetical observations were conducted with a degree of exactness which can hardly be exceeded. Nevertheless the results deduced by the author, from this measure alone, would lead to the supposition that the earth, instead of being flattened at the poles, is, in fact, more elevated at that part than at the equator; or, at least, that its surface is not that of a regular solid. For the measures of different degrees on the meridian, as reduced by Colonel Mudge, increase progressively toward the equator.

The singularity of these results, says M. Rodriguez, excites a suspicion of some incorrectness in the observations themselves, or in the method of calculating from them. The author, he adds, has not stated in his memoir what formulæ he employed in the computations of the meridian. But it appears, by the arrangement of his materials, that he used the method of the perpendiculars without regard to the conveyance of the meridians; and, although this method is not rigorously exact, it will have a very slight effect on the magnitude of each degree. It is, therefore, a more probable supposition that, if any errors exist, they have occurred in the astronomical observations:

but it is scarcely possible to determine the amount of the errors, or in what part of the arc they have occurred, except by a direct and rigorous computation of the geodetical measurement. M. Rodriguez has, therefore, had recourse to the method and formulæ invented and published by M. Delambre.

The means generally employed for finding the extent of a degree of the meridian consists in dividing the length of the total arc in fathoms, by the number and parts of a degree deduced from observations of the stars. But if these observations are affected by any error arising from the unsteadiness of the instrument, from partial attractions, or from any other accidental causes, then the degrees of the meridian will be affected without the possibility of discovering such an error in this mode of operating. It is, consequently, necessary in such a case to employ some other method, which may serve as a means of verifying the observations themselves, of detecting their errors, if there be any, or, at least, of shewing their probable limits.

M. Rodriguez, in his communication to the Royal Society, has given the result of his calculations from the data published by Colonel Mudge, and states that the magnitude of a degree of the meridian, corresponding to the mean latitude of the arc, measured by this skilful observer, corresponds very exactly with the results of the other measurements already noticed. He, however, declares that the appearance of progressive augmentation of degrees towards the equator, as represented by Colonel Mudge, is to be ascribed to errors in the observations of latitude, and that it is, especially, at one of the intermediate stations mentioned, that the observations of the stars are erroneous, notwithstanding the goodness of the instruments, and the skill and care of the observer.

M. Rodriguez concludes his memoir by expressing a wish that men of science in England, who have it so much in their power, would make new measurements in the southern hemisphere. Those which have been hitherto made in the northern hemisphere are extremely satisfactory by their agreement, and give great reason to presume that the general level of the earth is regularly elliptical; and hence we might expect the opposite hemisphere to be equally so, and to be a portion of the same curve. Nevertheless, remarks M. Rodriguez, the degree measured at the Cape of Good Hope by Lacaille, appears to indicate an ellipse of less eccentricity, or of greater axis. He conceives, therefore, that only one method remains of removing all doubt on this subject, which is, by repeating and verifying the measurement of the Cape, and, if possible, to extend it still farther to the north. He adds that it might be still further desirable if other measurements could also be undertaken either

in New Holland or Brazil. For though neither of these countries differs much in latitude from the Cape of Good Hope, they are so remote in longitude that a correspondence of measures so taken would nearly establish the similarity of all meridians.

Observations.—The great trigonometrical survey, which has excited the foregoing remarks of M. Rodriguez, originated in a great measure from a memorial of M. Cassini de Thury, transmitted by the French Ambassador to Mr. Fox, then Secretary of State, setting forth the advantage that astronomy would derive from constructing a series of triangles that should connect, trigonometrically, the two observations of Greenwich and Paris, and thus determine their relative positions more accurately than it was supposed could be done by astronomical observations. Both nations were at that time enjoying the blessings of peace, and the learned men of each country readily obtained from their respective Governments the assistance and patronage which such an undertaking required. The execution of the plan on the English side of the Channel was committed to the superintendance of General Roy, who had been long eminent as a most skilful engineer, and had been much engaged in pursuits of this kind.

On the 16th of April, 1784, Sir Joseph Banks, President of the Royal Society, accompanied by several others of its members, attended the first examination of Hounslow Heath, which was selected as the most proper place for that purpose, both on account of its great extent and the evenness of its surface. On the death of General Roy the care of conducting this great work was entrusted to Colonel Mudge, who had already distinguished himself by his superior talents, and who executed the arduous task committed to his charge in a manner that shews him to be most eminently qualified for the undertaking. The account of this important part of the English survey was drawn up and read before the Royal Society, in June, 1803.

While this work was going on in England, a similar one was undertaken in France, and on a larger scale, as the arc measure in that country, began at Dunkirk, and extended beyond the Frontiers to Barcelona in Spain. From these attempts connected with those of Svanberg in Sweden, and Major Lambton in India, it is evident that, in regard to the exact figure of the Earth, the wishes of scientific men have not been as much realized as might have been expected, when we consider the exquisite construction of the Instruments, which have been contrived for this purpose, the intelligence that has been evinced in the use of them, and the scrupulous accuracy, with which the

Observations have been computed. But, notwithstanding the sanguine hopes which were entertained, of removing every doubt on this question, have been greatly disappointed, yet the information we have obtained by this operation, is by no means inconsiderable. The remaining uncertainty is now restricted within very narrow limits, and we may conclude, with confidence, that the errors of observations are no longer concerned in the anomalies, that yet remain to be explained. Two causes are suggested, as most likely to produce the discordance; either a great irregularity in the actual figure of the Earth, or an extremely variable density of the materials, that lie below its surface. Both these causes are probably concerned, but what precise share is to be attributed to each, future observations can alone determine.

In pursuing M. Rodriguez through the various observations, which Colonel Mudge's Measurement has occasioned, we have perceived little matter, which is calculated to remove our remaining uncertainties. We do, however, most cordially unite with him in expressing a wish that, "men of science in England, who have it more in their power than others, may be enabled to throw future, and full, light on this interesting subject, by making new measurements in the Southern Hemisphere."

Observations of a second Comet, with remarks on its Construction. By W. HERSCHEL, L.L.D. F.R.S.—*Phil. Trans. Part II.* 1812.

By way of comparing the two comets, Dr. Herschel viewed them alternately. The first, within a nebulosity which, in the form of a brilliant head, was of great extent, had nothing resembling a nucleus. The light of this head was gradually much brighter, up to the very middle, its planetary body being invisible. The second Comet, on the contrary, although surrounded by a faint chevelure, from the central light to that of the chevelure, would not admit of the idea of a gradual condensation of nebulosity, such as was apparent in the head of the first Comet; but pointed out that the nucleus, and the chevelure, were two distinct objects.

Having a favourable opportunity of seeing the body of the Comet well defined, the Doctor ascertained its magnitude, with a very distinct ten feet reflector, by the three following observations.

1. With a low power, which gave a bright image of the nucleus, he kept his attention fixed upon its apparent size;

then withdrawing his eye from the telescope, he mentally reviewed the impression, its appearance had made on his imagination, in order to ascertain whether it was a faithful picture of the object; and by looking again into the telescope, he was satisfied of the similitude.

2. He used a deeper magnifier, and alternately viewed and remembered the appearance of the nucleus. It was fainter with this power.

3. Another observation was made in the same manner with a magnifier of 170. This showed the nucleus of a larger diameter, but much less bright, and not so well defined.

The morning after this observation, Dr. Herschel had recourse to his usual experiment with a set of globules, and by viewing them, at a given distance, with the same telescope and eye-glasses, he found that one of them gave, as nearly as could be estimated, the same magnitude with the first eye-glass, and was proportionally magnified by the second and third, with only this difference, that the highest power shewed the globule with more distinctness, than it did the nucleus.

The distance of the Comet from the earth, on the 20th of January, when its apparent diameter was determined, was 1,0867, the mean distance of the earth from the sun being 1; whence Dr. Herschel deduces a very remarkable consequence, namely, that the real diameter of the nucleus could not be less than 2637 miles.

Instead of that bright appearance, which in the first Comet had been considered as the head, there was about the nucleus of the second, a faint, whitish, scattered light, which may be called its chevelure.

In examining the chevelure of the comet with a ten feet reflector on the 1st of January, Dr. Hersehel found that it surrounded the nucleus, not in the form of a head, consisting of gradually much condensed nebulosity, but had the appearance of a faint haziness, which though of some extent, was not much brighter near the nucleus, than at a distance from it.

On the 2nd of January, Dr. Herschel viewed the two comets alternately. The first could only be distinguished from a bright, globular nebula, by the scattered light of its tail. The second comet, on the contrary, had nothing in its appearance, resembling such a nebula. It consisted merely of a nucleus, surrounded by a very faint chevelure; and had it not been for an extremely faint light, in a direction opposite to the sun, it would scarcely have been entitled to the name of comet having rather the appearance of a planet seen through an atmosphere full of haziness.

On the 8th. of January, the chevelure consisted of so faint

a light that, when magnified only 170 times, it was nearly lost. On the 18th, it was extremely faint, and of small extent And on the 20th, the light of the moon would not admit of farther accurate observations.

In regard to the tail of the comet, Dr. Herschel, on the 1st of January, with a low magnifying power, saw in the ten feet reflector an extremely faint scattered light, in opposition to the sun, forming the tail of the comet. It reached from the centre of the double eye-glass half way towards the circumference. On the 8th the narrow very faint scattered light beyond the chevelure remained extended in the direction opposite to the sun. And, on the 18th, he estimated the length of the tail by the proportion it bore to the diameter of the field of the eye-glass, which takes in 38′ 39″, and found that it filled about one quarter of it, which gives 9′ 40″. On the 20th of January the tail was no longer visible, on account of moonlight. From the angle, which it subtended in the last observation, its length will be found to have been 659,000 miles.

The remarks made by Dr. Herschel on the construction of this planet are highly interesting. In its physical construction it appears to approach nearly to the condition of a planet. In its magnitude it bears a considerable proportion to the size of the planets, the diameter of its nucleus being very nearly one-third of that of the earth. The light by which we see it is, probably, also planetary, that is, reflected from the sun. For if it were of a phosphoric self-luminous nature, we could scarcely account for its density. For example, the very small body of the first comet, at the distance of 114,000,000 of miles from the earth, bore a magnifying power of 600, and was even seen better with this than a lower one. Whereas the second, notwithstanding its large size, and being only at the distance of 103 millions, had not light enough to bear conveniently 107 times. But if we admit this nucleus to be opaque, like the bodies of the planets, and of a nature not to reflect much light, then its distance from the sun, which, on the 20th of January, was above 174 millions of miles, will explain the cause of its feeble illumination.

That the nucleus of this comet was surrounded by an atmosphere appears from its chevelure which, though faint, was of considerable extent. And the elasticity of this atmosphere may be inferred from the spherical figure of the chevelure, proved by its roundness and equal decrease of light at equal distances from the centre.

The transparency of the atmosphere is partly ascertained from our seeing the nucleus through it; but may also be inferred by analogy from an observation of the first comet. It

will be remembered that an atmosphere of great transparency, which had been seen for a long time, was lost when the comet receded from the sun, by the subsiding of some nebulous matter not sufficiently rarified to enter the regions of the tail. Now as the existence of this atmosphere, says Dr. Herschel, might have been doubled, when it was no longer visible the luminous matter suspended in it, which had already twenty days obstructed the view of it, happened fortunately to be once more elevated on the 9th of December, and thereby enabled him, from its transparency and capacity of sustaining luminous vapours, to ascertain the continuance of its existence. By analogy, therefore, it may be surmised that the faint chevelure of the second comet consists also of the condensation of some remaining phospheric matter, suspended in the lower regions, of an elastic transparent fluid, extending, probably, far beyond the chevelure, out of the reach of our perception.

The high consolidation of the matter contained in the second comet, is supported by the different appearance of the two comets in Dr. Herschel's observation of them on the 2d of Jan. In order to judge of them properly it is necessary to consider their situation in regard to the sun and the earth. The first comet was 192 millions of miles from the sun. The second only 164. The first was, at the same time, 262 millions of miles from the earth. The second only 83. But, notwithstanding the great disadvantage of being 28 millions of miles further from the sun, and about 179 millions farther from the earth, the first comet had the luminous appearance of a brilliant head, accompanied by a tail 45 millions of miles in length. Whereas the second comet, so advantageously situated, had only a very faint chevelure about its large but faint nucleus, with a still fainter tail, whose length did not much exceed half a million.

If then the effect of the action of the sun on the comets at the time of their perihelion passage is more or less conspicuous, according to the quantity of unperihelioned nebulous matter they contain, these celestial bodies may, by observation of cometic phenomena, be arranged into a certain order of consolidation, from which, in the end, a considerable insight into their nature and destination may be obtained. The three last observed comets will give, according to Dr. Herschel's account, the following results. The comet, which, in this paper, is the subject of his observations, is of such a construction that it was but little more affected by a perihelion passage than a planet would have been. This may be ascribed to its very advanced state of consolidation, and to the small share of phosphoric or nebulous matter in its construction.

The comet which appeared in 1807 was more affected, and although considerably condensed, shewed clearly that it conveyed a great quantity of nebulosity to the perihelion passage.

The comet of 1811 contained, with little solidity, a most abundant portion of nebulous matter, on which, in its approach to the perihelion, the action of the sun produced those beautiful phenomena, which afforded so favourable an opportunity for critical observations.

Observations.—The merited celebrity of Dr. Herschel, the advantages of his situation, the excellence of his instruments, and his known zeal and assiduity, stamp an authority on his communications which will ever cause them to be received with the highest consideration by the lovers of astronomical science. We are proud in avowing this feeling, and take pleasure in expressing the satisfaction which we have received in perusing the Doctor's communications in regard to the comets, which have lately made their appearance, and especially as they encourage us to join with him in the hope that our insight into their nature and destination, though at present in its infancy, will progressively lead to the most satisfactory results.

For an account of Dr. Herschel's Observations on the Comet which appeared in 1807, we refer to our fourth volume, p. 373.

On the Motions of Tendrils of Plants. By T. A. KNIGHT, *Esq. F.R.S.—Phil. Trans. Part II.* 1812.

SOME naturalists having supposed that the motions of the tendrils of plants had their origin in a certain degree of sensation and perception, and others rejecting this curious and unfounded hypothesis, Mr. Knight was induced to employ a considerable portion of time, and to exercise, as appears, no small portion of observation and discernment, in attending to the motions of the tendrils of different species of plants, and in ascertaining the true causes of their interesting appearances in this respect.

The plants which he selected for this purpose, were the virginia creeper (the ampelopsis quinquefolia of Michaux), the ivy, and the common vine and pea.

A plant of the virginia creeper, which grew in a garden pot, was removed to a forcing-house in the end of May, and a single shoot was made to grow perpendicularly upwards, being supported in that position by a very slender bar of wood, to which it was bound. The plant was placed in the middle of the house, and was fully exposed to the sun; and every object

around it was removed far beyond the reach of its tendrils. Thus circumstanced, its tendrils, as soon as they were nearly full grown, all pointed towards the north, or back wall, which which was at the distance of about eight feet. But not meeting with any thing in that direction to which they could attach themselves, they declined gradually towards the ground, and ultimately attached themselves to the stem beneath and the slender bar of wood.

A plant of the same species was placed at the east end of the house, near the glass, and was, in some measure, skreened from the perpendicular light; when its tendrils pointed towards the west, or centre of the house, as those under the preceding circumstances had pointed towards the north and back wall. This plant was removed to the west end of the house, and exposed to the evening sun, being screened, as in the preceding case, from the perpendicular light; and its tendrils within a few hours changed their direction, and again pointed to the centre of the house, which was partially covered with vines. This plant was then moved to the centre of the house, and fully exposed to the perpendicular light and to the sun; and a piece of dark-coloured paper was placed upon one side of it, just within the reach of its tendrils, and to this substance they soon appeared to be strongly attracted. The paper was then placed upon the opposite side, under similar circumstances, and there it was soon followed by the tendrils. It was then removed, and a piece of plate-glass was substituted; but to this substance the tendrils did not indicate any disposition to approach. The position of the glass was then changed, and care was taken to adjust its surface to the varying position of the sun, so that the light reflected might continue to strike the tendrils; which then receded from the glass and appeared to be strongly repulsed by it.

The tendrils of the Virginia creeper very closely resemble those of the vine in their internal organization, and in originating from the albromous substance of the plant, and in being under certain circumstances convertible into fruit stalks. The claws, or claspers of the ivy, on which Mr. Knight made experiments, appear to be cortical protrusions only; but to be capable of becoming perfect roots under favourable circumstances. Experiments, in every respect similar to those which he had made on the Virginia creeper, were made on this plant. But he found it necessary to place the different substances, to which he proposed that the claws should attempt to attach themselves, almost in contact with the stems of the plants. He observed that the claws of this plant evaded the light, just as the tendrils

of the Virginia creeper had done; and that they sprang only from such parts of the stems as were fully or partially shaded.

A seedling plant of the peach tree, and one of the Virginia creeper and ivy, were placed nearly in the centre of the house, and under similar circumstances, except that supports, formed of very slender bars of wood about four inches high, were applied to the creeper, and the ivy. The peach tree continued to grow nearly perpendicularly, with a slight inclination towards the front and south side of the house, whilst the stems of the creeper and ivy, as soon as they exceeded the heights of their supports, inclined many points from the perpendicular line in the opposite direction.

It appears, therefore, that not only the tendrils and claws of these creeping dependent plants, but that their stems also are made to recede from light, and to press against the opaque bodies which nature intended to support and protect them.

Mr. Knight believes that M. Decandole first observed, and he accords with him in opinion, that the succulent shoots of trees, and herbaceous plants, which do not depend upon others for support, are bent towards the point from which they receive light, by the contraction of the cellular substance of their bark upon that side. The operation of light upon the tendrils and stems of the creeper, and ivy, appears to produce diametrically opposite effects, and to occasion an extension of the cellular bark wherever that is exposed to its influence. And Mr. Knight conceives that this circumstance affords a satisfactory explanation, why these plants appear to seek and approach contiguous opaque objects, just as they would do if they were conscious of their own feebleness; and, also, of power in the objects to which they approach to afford them support and protection.

The tendril of the vine, as already stated by Mr. Knight, is internally similar to that of the creeper, though its external form and mode of attaching itself, by twining round any slender body, are very different. Some young plants of this species, which had been raised in pots the preceding year, and had been headed down to a single bud, were placed in a forcing-house with the plants already mentioned; and the shoots from these were bound to slender bars of wood, and trained perpendicularly upwards. Their tendrils, like those of the Virginia creeper, when first emitted, pointed upwards; but they gradually formed an increasing angle with the stems, and ultimately pointed perpendicularly downwards; no object having presented itself to which they could attach themselves. Other plants of the vine, under similar circumstances, were trained horizontally; when their tendrils gradually descended beneath

their stems, with which they ultimately stood nearly at right angles.

A third set of plants were trained almost perpendicularly downwards, but with an inclination a few degrees towards the north; and the tendrils of these permanently retained very nearly their first position relatively to their stems. Whence, it appears, that these organs, like the tendrils of the creeper, and the claws of the ivy, are to a great extent under the control of light.

A few other plants of the same species were trained in each of the preceding methods. But proper objects were placed in different situations near them, with which their tendrils might come into contact; and by these means an opportunity was afforded to Mr. Knight, of observing, with accuracy, the difference between the motions of these, and those of the Virginia creeper under similar circumstances. The latter almost immediately receded from light, by whatever means it was made to operate upon them; and they did not subsequently shew any disposition to approach the points from which they once receded. The tendrils of the vine, on the contrary, varied their positions in every period of the day, and, after, returned again during the night to the situations they had occupied in the preceding morning; and they did not so immediately, or so regularly bend towards the shade of contiguous objects. But as the tendrils of this plant, like those of the creeper, spring alternately from each side of the stem, and as one point only in three is without a tendril, and as each tendril separates into two divisions they do not fail to come into contact with any object within their reach; and the effects of contact upon the tendril are almost immediately visible. It is made to bend towards the body it touches, and, if that body be slender, to attach itself firmly by twining round it.

The tendril of the vine, in its internal organization, is apparently similar to the young succulent shoot and leaf-stalk of the same plant; and it is as abundantly provided with vessels or passages for the sap; and, Mr. Knight has proved, that it is alike capable of feeding a succulent shoot or a leaf when grafted upon it. He conceives it not improbable, therefore, that a considerable quantity of the moving fluid of the plant passes through its tendrils, and that there is a close connection between its vascular structure and its motions.

Mr. Knight, in the Philosophical Transactions, of 1806, states, that centrifugal force, by operating upon the elongating plumules of germinating seeds, occasions an increased growth and extension upon the external sides of the young stems, and that gravitation produces correspondent effects; probably by

occasioning the presence of a larger portion of the fluid organizable matter of the plant upon the one side, than upon the other. The external pressure of any body upon one side of a tendril will probably drive this fluid from one side of the tendril, which will consequently contract, to the opposite side, which will expand; and the tendril will thence be compelled to bend round a slender bar of wood or metal, just as the stems of germinating seeds are made to bend upwards, and to raise the cotyledons out of the ground; and in support of this conclusion, Mr. Knight observes, that the sides of the tendrils, where in contact with the substance they embraced, were compressed and flattened.

The actions of the tendrils of the pea were so perfectly similar to those of the vine, that Mr. Knight thought it needless to particularize them.

An increased extention of the cellular substance of the bark upon one side of the tendrils, and a correspondent contraction on the opposte side, occasioned by the operation of the light, or the partial pressure of a body in contact, appeared in every case, which has come under Mr. Knight's minute, and accurate, observation, to be the obvious cause of the motions of tendrils. And, therefore, in conformity with the conclusions, which he states, that he drew in a former memoir, respecting the growth of roots, he confidently infers that they are the result of pure necessity only, uninfluenced by any degrees of sensation, or intelectual powers.

Observations.—Mr. Knight's experiments appear to us to justify the conclusion which he draws from them, and tend to overthrow the hypothesis of those ingenious speculists, who attribute to certain plants, the capacity of animal sensation, and the powers of intellect. Plants obviously exist for the purposes of vegetation alone, and for the production of those fruits which constitute the necessary food and medicine of man, and other animals. Though this may be considered as a subordinate end of existence, yet it appears decided and fixed in its intention and operation, and evidently assigns to plants a distinct province in the economy of the universe. Nature has bestowed upon them all that was proper to be bestowed. For what benefit would ariseto the creation, by communicating to plants, the faculty of animal sensation, or an attenuated intellect? Why should a vegetable be capable of knowing other vegetables, or indulging in the mutual sympathies of pleasure and pain? Is it not sufficient, that they can attract the air, the light, and the juices, which nourish them, *after the manner of plants*, and administer by their beauty, by their medicinal and

nutritious qualities, to the pleasure, the health, and food of man, and the other members of the animal creation? In our youthful days, we derived much amusement from perusing the ingenious theories of a class of fanciful writers, by whom the highly sensitive character of various plants was considered as a fair ground for ranking them with a higher order of nature's products. If similarity of movement in some cases, and liability to like external changes in others, justify conclusions of this description, it appears to us, that the very admissions, which would raise plants to the dignity of sensation and intelligence, would tend to lower the pride of man by a mortifying display of comparative functions. We are content, therefore, with holding the generally received doctrine—that there is a distinct line of separation—an invincible barrier, between the mineral, the vegetable, the animal, and intellectual worlds: and we take pleasure in witnessing the successful labours of talent, in the discovery and display, of all that is useful, and interesting, in these separate kingdoms of nature.

An easy Method of forming all kinds of Ovals, commonly known by the name of Gardeners' Ovals.—Phil. Mag. No. 175.

THE oval is an elliptical figure formed by a curved line, which re-enters into itself, and which is composed of several portions of a circle, having various centres.

The execution and demonstration of this figure presuppose a portion of knowledge, not possessed by every individual. But a practical method of forming it has been long known; and an acquaintance with it, will be useful to artists, gardeners, and others. The figure, which accompanies the description of this method, exhibits the two diameters of the oval, one long and the other short, and intersecting each other at their middle point. Two points are taken in the longer diameter, equidistant from the centre, and consequently from the termination of the line. Two stakes, at these points, are well fixed in the ground, and a string stretched from one of the stakes, to the end of the long diameter in the opposite direction. The string is then doubled and knotted firmly, so that, by placing between the two ends at the extremity a tracing stick, it points precisely to the end of the long diameter, and the stakes are respectively embraced by the string. The tracing stick is then guided, with the string well stretched but moving freely, from the point mentioned, till it reaches the opposite termination of the long diameter, when half the figure

will be effected; and by causing the tracing stick to be moved in the reverse direction till it reaches the point from which it first moved, the figure will become complete.

An oval may be always struck, whatever be the length of the great and small diameter, by taking the difference which is between them, and by disposing of the difference in such a manner as that half of the length which exceeds the small diameter, may be subtracted from each extremity of the greatest diameter. If, for example, the greater diameter is twenty feet long, and the less twelve, it is obvious, that the greater diameter exceeds the less, eight feet. In this case, the stakes must be placed four feet from each termination of the greater diameter.

It is scarcely necessary to observe, that the oval will be longer in proportion to the nearness of the stakes to the ends of the longer diameter; and that the more nearly will it approach the figure of the circle, as the stakes approach the centre of the line.

Demonstration of the Fundamental Property of the Lever. By DAVID BREWSTER, L.L.D. F.R.S. Edin.—*Trans. Royal Society Edin. and Repertory of Arts, &c. No.* 127.

DR. BREWSTER prefaces his demonstration by the following remarks.—It is a singular fact, in the history of science, that, after all the attempts of the most eminent modern Mathematicians, to obtain a simple and satisfactory demonstration of the fundamental property of the lever, the solution of this problem, given by Archimedes, should still be considered as the most legitimate and elementary. Galileo, Huygens, De la Hire, Sir Isaac Newton, Maclaurin, Landen, and Hamilton, have directed their attention to this important branch of mechanics. But their demonstrations are, in general, either tedious and abstruse, or founded on assumptions, too arbitrary to be recognised as a proper basis for mathematical reasoning. Even the demonstration, given by Archimedes, is not free from objections, and is applicable only to the lever, as a physical body. Galileo, though his demonstration is superior in point of simplicity, to that of Archimedes, resorts to the inelegant contrivance of suspending a solid prism from a mathematical lever, and of dividing that prism into two unequal parts, which act as the power, and the weight. The demonstration, given by Huygens, assumes as an axiom, that a given weight removed from the fulcrum, has a greater tendency to turn the lever round its centre of motion, and is, besides, applicable only to

a commensurable proportion of the arms. The foundation of Sir Isaac Newton's demonstration, is still more inadmissible. He assumes, that, if a given power act in any direction upon a lever, and if lines be drawn from the fulcrum to the line of direction, the mechanical effort of the power will be the same, when it is applied to the extremity of any of these lines; but it is obvious, that this axiom is as difficult to be proved as the property of the lever itself. M. De la Hire has given a demonstration, which is remarkable for its want of elegance. He employs the *reductio ad absurdum*, and thus deduces the proposition from the case where the arms are commensurable. The demonstration, given by Maclaurin, has been highly praised; but if it does not involve a *petitio principii*, it has, at least, the radical defect of extending only to a commensurable proportion of the arms. The solutions of Landen and Hamilton are peculiarly long and complicated, and resemble more the demonstration of some of the most abstruse points of mechanics, than one of its most simple and elementary truths.

In attempting to give a new demonstration of the fundamental property of the lever, which shall be, at the same time simple and legitimate, Dr. Brewster assumes, he says, only one principle, which has been universally admitted as axiomatic, viz. *that equal and opposite forces, acting at the extremities of the equal arms of the lever, and at equal angles to these arms, will be in equilibrio.* With the aid of this axiom, the Doctor, in three propositions, endeavours to establish the fundamental property of the lever. How far he has succeeded in improving upon former labours, we must refer our mathematical readers to the plates and demonstrations which accompany his communication, and also to the General Observations we made on this subject in our Fifth Volume, page 31.

On the Cause of audible sound in Vibrating Strings, Tuning Forks, &c.; on the use of Hawkins's Mouth Tuning Forks; on Earl Stanhope's proposed Steel Piano-Forte Strings, &c. —Phil. Mag. No. 165.

It is stated, that Mr. Gough, of Middleshaw, has, in a late number of Mr. Nicholson's Journal, given a paper, in which he shows, by an experiment on a musical string, one end of which was fastened to the end of a table, and the other to a small cylinder of wood held in the hand, and by which the string was pulled tightly, at the same time that it was put into a vibrating motion, that the pulses excited in the ear by the sound, do not proceed directly from the string, but from, the

fibres of wood in the table—that these fibres are agitated by the vibrations of the string, analogously to the strokes of a drumstick on the parchment cover of a drum, or the fingers on that of a tambourine, but repeated with extreme quickness and regularity.

In confirmation of this conclusion of Mr. Gough, the correspondent begs to mention to the musical readers of the Philosophical Magazine, a fact, which he says, that many of them have, without doubt, noticed, namely, that a tuning fork gives out no audible sound, after that excited by the mere stroke given to it, while held in the hand; and that it is essential, to rest the end of its handle on a table, or firm piece of wood, to hear its tone. And, in order that this tone may be clear, and perfect, it is best to have the end of the handle of a tuning-fork wrought to a blunt point, that it may have only one, and that a firm, bearing on the wood; for, if they be knobbed, or flat, at the end, as they are too often made for sale, they are apt to give a jarring, and interrupted, sound.

Under the article, "concert pitch," in Dr. Rees's New Cyclopædia, Mr. J. I. Hawkins is mentioned as having applied this principle to the formation of a small and slender steel tuning fork, capable of being inclosed in a tooth-pick case, the handle of which, being placed between the teeth, the two legs of the fork are strongly pressed between the thumb and finger, and suddenly let go, by which means vibrations are excited in the teeth, &c. of the operator, which effectually give him the sound, without communicating it to any other person. Mr. Hawkins formerly manufactured these instruments for sale.

This writer conceives, that the above facts tend strongly to show, that improvements in the strength and quality of tone in stringed instruments, are to be sought for in the sonorous, or elastic, qualities of the materials, which compose the frames, and supports of the strings, in the soundness and perfection of framing and workmanship, and not so much, as is supposed, in the temper and quality of the metallic strings, which are used to excite the wood to sound. The latter, according to the author's statement, is a favourite idea with Earl Stanhope, who is represented as having gone so far, as to manufacture steel wire, at his country-house, for the purpose of making instruments with single strings, which are to excel those with two or three, now in common use. He concludes by calling the consideration of those individuals, who may be more learned in these subjects than himself, to that passive kind of elasticity in the fibres of wood, bone, &c. which fits them to receive and transmit to the ear vibrations of any given velocity, while stretched strings, and columns of air in pipes, &c. can only

yield sounds determined by their lengths; and even to receive the most incommensurate vibrations at the same instant; and which scarcely ever coincide, as readily as those, which are commensurate, and often coincide.

An Apparatus for Preventing the Accumulation of Air in Conduit Pipes, &c. &c. By JOSEPH STEEVENS, *Esq.—Phil. Mag. No.* 167.

THE object of Mr. Steevens's communication is, by the description of a satisfactory apparatus, to meet the objections of those, who conceive, that the mode suggested for supplying the sea-water baths, and infirmary, proposed to be established in the vicinity of London, by means of iron pipes from Southend, would be ineffectual, in consequence of the quantity of air, which would accumulate at certain elevated points, over which the pipes will pass.

Mr. Steevens causes a tube, of about two inches in diameter, and six inches long, to project from the upper part of the iron pipe for conducting the water. Into this tube is screwed a globular vessel about ten inches in diameter; and, into this globe is screwed another tube, about one inch in external diameter, having a conical opening through it, a quarter of an inch on the inside, and half an inch on the outside end of it. In the globe is a globular float, about seven, eight, or nine inches, in diameter, as circumstances may require. This globe carries two spindles, or rods, the one projecting downwards, about half an inch in diameter, carrying a valve, and the other projecting upwards, carrying, also, a valve. This passes through a guide in the upper part of the globe, as does the lower rod through a guide in the lower part of the globe. The part of the lower rod, which passes through the guide, is flat, in order to prevent it from turning round, in the operation of screwing the float to it. The upper tube is provided with a valve, and a weight, nearly equal to the weight of the valve.

Things being in this situation, let us suppose water to flow into the pipe, till it rises to the point, when one half of the diameter will be occupied by air, and therefore only one half of the water which the pipe is capable of conveying would be allowed to pass. But as there is no water in the globe, the float will rest on the guide communicating with the lower tube, and the valve be opened through which the air will escape until the float is raised by the water rushing into the globe, when the valve will be shut, and none of the water be suffered to escape. This operation will be repeated as often as a quan-

tity of air sufficient to fill the globe is collected. The valve in the upper part of the apparatus is attached, in order to prevent any air from entering the pipe, by the tendency of the water to retire, in case a partial interruption in the supply should take place; or in the event of a pipe bursting at a point just below that to which this apparatus is affixed.

In the lower tube are two flanches. The lower is intended to prevent the valve and its rod from falling into the pipe, and would in many instances supersede the necessity of the upper valve; the upper flanch is to receive the valve, and prevent the escape of water, if it should be necessary to remove the globe or the upper tube for the purpose of repairs, &c. It is easy to see that by unscrewing the upper tube the float would rise and close the valve. The same effect would be produced by unscrewing the globe, or by detaching its upper part, and the pressure of the water would effectually prevent its opening; as, on several points of the pipes to be used for the above purpose, the pressure will be equal to six or eight times that of the atmosphere.

Observations.—The description of this apparatus without the plates, may, perhaps, be inadequate to the purpose of conveying a full idea of its competency to the end proposed. We must, therefore, recommend such of our readers, as may be interested in the subject, to a perusal of the original article from which we have made the above compressed account.

Substitute for a Repeating Watch. By Mr. E. WALKER.—*Phil. Mag.* No. 167.

MR. WALKER, after many unsuccessful attempts to construct an instrument to supply the place of a repeating watch, at a small expense, and that might prove equally useful, found that a common watch with a very little alteration would answer the purpose perfectly well.

To accomplish this purpose he made notches with a file in the rim of the inner case of a common watch, against every hour upon the dial, except three, six, nine, and twelve. These tangible marks are made no deeper than just to receive the nail of the finger or thumb as it is drawn over them. The hour of twelve is known by the pendant, and little pins are fixed into the case at the hours of three, six, and nine, projecting outwards about the twentieth of an inch to distinguish those hours from the rest.

To ascertain the time in the dark by this watch, nothing more is to be done than to open the glass and feel with the finger the situation of the hour hand, and count the tangible marks, beginning at three, six, nine, or twelve, to find the hour; and by the same means the minutes are found.

By a watch of this construction the time may be ascertained in the dark to a much greater degree of precision, according to Mr. Walker's statement, than by a repeater, and, also, without disturbing the repose of any person who may be near it.

Observations.—Mr. Walker's contrivance is ingenious; and if it be in any cases desirable to secure the object proposed, we conceive that he has rendered a service proportioned to the diminution of the expense. But the instances in which such contrivances can be rendered really useful are so rare, that the community can receive little benefit, even by this cheap mode of ascertaining the time during the night season. And the vanity of the opulent will preclude them, at least, from taking advantage of Mr. Walker's substitute.

On the Rev. Mr. LISTON'S *Euharmonic Organ, and his "Essay on perfect Intonation," just published for explaining fully the principles of tuning, and of performing on this Organ with perfect harmonies in almost every possible variety of keys and passages. By Mr.* J. FAREY, *Sen.—Phil. Mag. No.* 169.

MR. FAREY'S communication consists in little more than in announcing that the work, which had been for a considerable time expected by many, for explaining the principles and practice of a "Musical Scale, without any temperament or imperfection in its harmony," had made its appearance, and might be procured at the shop of any book or music-seller. He mentions several eminent musicians who have since fully examined and tried the organ, with twenty pipes in each octave (through three stops), yielding sixty sounds in each octave, which was exhibited at Messrs. Flights and Robson's, in St. Martin's-lane; and that the following Professors; *viz.* Mr. W. Shield, Mr. T. Greatorex, Mr. J. Davy, and Mr. Samuel Westley, have since voluntarily transmitted to Mr. Liston very ample testimonials of the practicability and great value of his improvements on the scale of keyed instruments.

Letter from Mr. J. STANCLIFFE *to Mr.* J. ALLAN, *respecting Mr.* ALLAN'S *improved Dividing Engine.*

Communication from Mr. J. ALLAN *respecting his improved Dividing Engine.—Phil. Mag. No.* 175.

THESE communications confessedly originate in the observations which our former Numbers contained respecting Mr. Allan's Dividing Engine. It is far from our intention and disposition to commence, or prosecute a "wordy war," and especially with irritable antagonists. The character of the Retrospect, hitherto, stands aloof from the profession, and we hope its continued consistency will ever free us from the just imputation of such a spirit.

As Mr. Stancliffe, therefore, assures us in his letter, that "he will give us no farther interruption," we have only to say, that it is by no means our wish to shake his wise resolution. And, in regard to Mr. James Allan, we beg to remark, that his protracted observations on the *extreme value* of his Dividing Engine, and his reiterated denunciations (may we be permitted to call them calumnies?) on the score of our ignorance of its transcendant merits, are neither calculated to change our opinion, as already stated, nor to cause us to subscribe to the justice of his personal reflections. We, therefore, dismiss the subject by referring the readers of the Retrospect, if they be inclined to discover the merits of the case, to those of our Numbers which contain the communications of Messrs. Stancliffe and Allan, and our consequent observations.

Description of a Machine for pumping Water, used in the East. By M. CHASTELLAN, *Author of "Travels in the Morea."—Repert. of Arts, and Phil. Mag. No.* 173.

THE description of this machine is prefaced by some interesting observations on irrigation, and an account of the method of watering gardens at Constantinople; it then proceeds to state that a kind of triangle is formed over the well, the beams tied together at the top, and sunk into the earth at proper distances below.

At the summit of the triangle a pulley is fixed. Lower, and nearly as high as the reservoir, there is a pulley or wheel which turns upon pivots. The cord, which is attached to the large aperture of the bucket, passes into the pulley. Another cord,

fixed to the extremity of this funnel, passes over the wheel, and both are fastened to a windlass.

If we suppose the bucket at the bottom of the well it will be filled with water; and when the windlass is turned, and the cords are stretched, it begins to ascend; the small end of the bucket is folded up, and, in this position, the water which it contains cannot escape, this extremity being as high as the large aperture. By always drawing at once the two cords, the bucket will preserve the same position until it rises to the edge of the well; but when it arrives to the height of the reservoir the small extremity passes above the wheel, the other ascends to the pulley; the bucket is unfolded, it assumes the real form of a funnel, the office of which it performs, and the water finally escapes by the lower aperture and falls into the reservoir. The windlass immediately goes round. The bucket resuming its first position descends again by its proper weight to the bottom of the well, where it is again filled; the windlass turns round again and causes the bucket to ascend a second time, and so on. In a little time the reservoir will be filled, and afterwards pours the water by a gutter into a lower basin, from which it may be distributed over the whole garden.

It is obvious that some time is lost in the return of the windlass. But this return may be made useful by placing the windlass across the middle of the well, but in such a manner as that the handle may come to one side, between two machines. We shall then have two reservoirs. Each of the cords attached to the small end of each bucket, after having passed over the pulley will traverse the reservoir, pass under another parallel pulley, and will return to unite with each of the cords in the pulley; the four cords will be fixed by their extremity to the windlass, so that by being unrolled and developed successively, one of the buckets will be filled at the bottom of the well, while the other will empty itself into the reservoir.

This mechanism may be modified according to circumstances. If the well be situated in low ground the reservoir must be raised to a height sufficient to command the whole garden. On the banks of a river it will be sufficient to drive two piles into the current; they will support the extremity of two horizontal beams, the other extremity of which will rest on the bank. The whole mechanism will be established on these two powers, and the reservoir situated on the banks will be raised to the height desired, in order that the water may be carried to a distance by means of wooden troughs or gutters.

In regard to the disposition of the cords, pullies and rollers, it is recommended to place the pulley at such a height that the

bucket may be perfectly developed on rising to the height of the reservoir; the cords ought to be attached to the two extremities of the roller, which serves for the windlass; and, if it be possible, the length of the roller should be proportioned to that of the cords which it ought to receive; for it would be desirable that they should not make several revolutions upon themselves, which, however, can scarcely be avoided when the well is deep.

As to the proportion of each bucket, and its capacity, it must vary according to the quantity of water wanted. An approximate table is added.

Every bucket represents a truncated cone.

A cone five feet in height, on a base twenty inches in diameter, will contain nine pail-fulls, and nine-tenths, the dimensions of each pail being nine inches in diameter, and six inches in height. A cone, four feet by sixteen inches, will contain a cubic foot, or three pail-fulls and three-tenths.

An allowance should be made for the loss of water occasioned by the fold which the cone contracts in ascending from the bottom of the wall, as it is suspended by the two extremities. This loss may extend to half a pail full.

The largest of these buckets cannot be easily managed but by means of a windlass, furnished with a hopper-wheel. But the smallest may be managed by a simple windlass with a handle.

The bucket is the most important part of this machine, indeed in this consists the *innovation;* for the rest of the mechanism may be varied ad infinitum, and the same kind of bucket may be applied to all the machines, which are in use for drawing water. It will procure, in the same space of time, and with the same force, a volume of water much more considerable. It combines also another great advantage, that of conveying the water to any given height, by means of one or more machines of this kind. For this purpose it is only necessary to raise the reservoir parallel to the level of the greatest height of a sloping piece of ground, and to cause the water to flow from the reservoir into channels formed by hollow trees, or simply by two planks nailed at right angles, and tarred at the joinings.

In order to reach a perpendicular height of twelve feet, it will be requisite to elevate the first reservoir on four posts to this height. We may conceive that by carrying the pulley some feet above the reservoir, the bucket will ascend, and will thus be equally well emptied at this height as at the level of the ground, although the mechanism necessary is placed below this reservoir. An advantage will even be gained by this; for

the gardener will be protected from the sun, and the four posts may be concealed by trellis-work, to which may be applied vines or other creeping plants and flowers, which will give the scaffolding the appearance of a harbour.

The above described mechanism may be applied to the external wall of a house. And if a reservoir be formed on the roof, the water may be conveyed throughout the whole of the apartments and answer many useful purposes

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Observations.—We are inclined to think that in the various situations in which this machine has been brought into use, it possesses no mean advantages; and, that in cases also of a similar nature, it may be adopted with every promise of utility and success, even in countries which are not subject to the long and periodical droughts peculiar to eastern countries. Whatever facilitates the art of irrigation, whether the product of native or foreign ingenuity, will be viewed with pleasure by those who are employed in rural occupations, and by such the paper before us will, we conceive, be read with considerable interest.

On the Economical Construction of the Piers of Bridges. By Mr. J. W. Boswell.—*Repertory of Arts, No.* 122.

Mr. Boswell commences his observations on this important subject by illustrating the two great principles which, in the construction of bridges, have particular reference to the nature of the piers. According to the first and most general, each arch, he says, is designed to rest on the adjacent piers, independent of any farther support. In the other method, the thrust of one arch balances that of the other, and the resistance of the abutments ultimately confines the whole, and gives it the required stability.

The latter method, which is of French origin, besides the beauty of great lightness in the general appearance, admits of forming the arches very flat, and the piers very narrow; which are great advantages, when the banks and adjacent country are low and the stream rapid, subject to floods, and confined in a narrow channel. But it is deficient in security in case of accidents; for if any of the piers sink, against which the most skilful engineers have not been always able to guard, the whole bridge is in danger of destruction. One of the most striking examples of this species of bridge is that of Mayence in France, built by Perronet. In order to shew of what lightness piers

were capable according to this method, he has made the whole of the piers of this bridge, at the ordinary level above the water, to consist of pillars, connected in pairs, and arched above.

The primary mode of building bridges, in the middle ages at least, ran into the contrary extreme. For, to render each arch independent of the rest, the piers were made so enormously broad as, in some instances, to block up the river, produce frightful cataracts, and occasion the greatest damage to the navigation both in their vicinity and to a great distance above them. To the disgrace of the Metropolis, a flagrant instance of this is still permitted to exist in London bridge, in the cataracts of which it has been proved before the House of Commons, that between thirty and forty lives, and property to the amount of £40,000 are annually lost.

Mr. Boswell says, some of the best judges of the subject have laid down a simple rule for the construction of the supports of arches of another nature, that seems applicable, also, to the piers of bridges, which is, to make the pier of that breadth, which will include within its base, the catenary curve continued down to it, that will apply nearest to the arch intended. Therefore, when this rule is observed, where flat arches are required with narrow piers, that curve of equilibrium must be sought for the construction of the arch, which will admit of the most speedy approximation towards a vertical line in the vicinity of the piers. Elliptical and cycloidal curves are of this nature, and are therefore probably preferable. But to determine this point accurately, according to the peculiar nature of each bridge, the works of those eminent and well known mathematicians, who have written so amply on the subject, should be consulted, as they have left nothing to be desired for its adjustment.

The French method of building bridges, already mentioned, does not admit of any economy in the materials of the piers, since, from their small dimensions, and the great proportional weight, which they have to support, the hardest and most solid substances must be used in their construction; and entire blocks of granite, reaching across their whole breadth, cannot be deemed more strong or unyielding than their stability requires.

But for the primary method of building, in which each arch is to be independent of the rest, the piers must necessarily be of so great a breadth, after every reduction of it consistent with safety, as to admit of greater latitude in the materials, of which they are built; for, the weight which they have to bear, being divided over a larger base, each portion of it will have

less to sustain, and therefore less solid, and consequently less expensive, materials might evidently be safely used in their general construction. But other considerations, also, demand attention in the choice of materials, for they must be of that nature, as not to be liable to abrasion from the action of the current; and in navigable rivers, to be able to bear, without injury, the occasional shocks of heavy barges, and other weighty floating matters, driven against them by the force of the stream. These circumstances, however, do not require the whole of the pier to be composed of hard and solid masses, but only the external part; and, it is on this point of distinction that an evident opening is offered for economy in the construction of such piers, without any risk of their stability. For, though the outside might require to be built of large blocks of granite, which would be the case in the instance mentioned, smaller materials, at least, would be sufficient for the internal part of the pier, where they could be exposed to no shocks to displace them; and this circumstance alone would produce a very great saving in the construction of the pier, as small masses, even of the same materials, can be procured at a much cheaper rate, and require much less labour and expense, both in regard to their conveyance and final adjustment.

For these reasons, it is obvious, that a pier might be constructed perfectly sufficient for the situation, above stated, by forming the whole of the external part of the pier of blocks of granite, or of stone as near it in hardness and size as can be procured, where granite is not to be had; and by building the internal part in courses, equal to the thickness of the external blocks, of stone of a smaller size, as near the granite in hardness as can be procured, or of small pieces of granite, if not too dear, packed close, and laid even, and the whole well grouted at every course.

If farther security should be required, walls of large blocks of stone might be built internally across the breadth of the pier, in number according to its length, as the work was carried up; and the whole might be covered with a bed of such blocks, at a level with the springing of the arches.

The materials which appear best, in regard to durability and cheapness, for filling up the internal part of piers, in the neighbourhood of London, are the large square Scotch paving stones, of which the quantity required for this purpose can be easily had; and they can, from their size, be almost as easily carried and built up as bricks; while their squareness admits of a solidity in building, of which materials of irregular forms would not be capable; and their hardness, being equal to that of the external courses, would banish all apprehension of any

one part of the pier yielding more than another, which a filling of softer materials might justly occasion. And next to these stones, the Kentish rag-stones would probably be the best materials, for filling up the internal part of piers, in the same vicinity.

Some have supposed, that bricks would be sufficiently durable for filling materials in the manner proposed, but no bricks seem to have hardness sufficient to bear a great pressure without yielding more than granite, and inequality in this respect would evidently produce bad consequences. Besides this, the durability of bricks, in a wet situation, does not appear to be sufficiently established from any well known instances, to render them adviseable for water-works, though some authors have recommended them for the entire construction of the piers of bridges. But it is obvious, that they did not sufficiently attend to the shocks, to which piers are liable from heavy floating masses, and to bear which such small bodies could in no respect be adequate. If, however, bricks should be thought sufficiently defended from the action of the water, as well as from external shocks, by the granite casing; to render them fit materials for filling piers, the precautions, above mentioned, of building cross walls of granite, and covering the top of the pier with a bed of the same materials, would be adviseable.

In defence of the stability, arising from the filling of small hard materials cemented, as proposed, by grouting, Mr. Boswell urges the great durability and strength of the buildings of the Romans, which were performed in this manner; some of which were erected in a much less cautious manner than that proposed, it being apparent, from some of their remains, that the small stones which compose them were thrown in at random between the sides of moveable cases, and were afterwards cemented by grouting. Few, who have paid attention to building, are ignorant of the great strength of grouted walls in common building. Mr. Boswell mentions the following instance as a case in point:—One of the long locks of the Grand Canal, near Dublin, having been ordered to receive some alterations, which required a considerable part of the wall to be taken down, the square cut stone in front was removed with comparative facility; but the back part, which consisted of common building stones grouted together, was so firmly united that the greatest difficulty was experienced in its removal, and this was, at last, effected by blasting with gunpowder.

The form of the pier is of primary importance, even when considering the subject in an economical point of view. So

that form, which opposes the least resistance to the stream for a given breadth, evidently produces the greatest effect for the sum expended on it. The sides should, on this account, be formed in right lines, parallel to each other, according to the usual custom. For, if the pier should be entirely formed of a row of pillars (from a notion of extending Perronet's plan), it is demonstrable, that every pillar would, in proportion to its surface, increase the resistance to the passage of the stream; and of course, the force of the latter, tending to overthrow the pier, would receive an increase in the same ratio; and this mode of construction would, therefore, have all the bad effects on the river, of a pier of much greater breadth, while its power of resistance received a great diminution, instead of the increase of stability, that the broad pier would occasion.

The extremities of the pier, however, admit of a considerable improvement to the common form. The right lined angles, in which they usually terminate, reflect the stream to some distance from the sides and, similar to the form above mentioned, occasion the bad effect of a broader pier, without its advantage of stability. The sides of the angle, therefore, instead of being right lines, should be curves, gradually approximating to the direction of the sides of the pier, as they come nearer to them, from about half the distance between the sides, and the apex; and from the same point to the apex, a similar curve should be formed in a reversed and concave position. The effect of this form would be, to give the stream gradually that lateral motion, which is necessary for it, in passing the pier, and afterwards to admit of its losing that lateral motion more as it approached the side of the pier. The proper curve to produce this effect, may be determined by calculation; but of the curves easily formed, the cycloid would come sufficiently near that, which is desired for practice. This form of the apex, on account of its sharpness, would require the points of the piers to be made of cast-iron, which is now easy to effect. But if the architect would admit of the use of stone only, then while the half of the head next the sides of the pier, was formed as directed, that towards the apex should be rounded off, so as to produce a circular termination, as angles in stone work, built in water, are not adviseable, particularly where they are exposed to shocks of heavy floating bodies. The extremities of the piers towards the lower part of the river, should, also, be shaped in the same manner, even in rivers out of the reach of the tides, since it adds to the stability of the piers, that the water should press on them behind as much as possible, till the divided streams finally close. And

this may be effected very nearly by making the sloped extremity of the breakwater of such a length beyond the pier, as shall admit of water running laterally half the breadth of the pier, while the current advances the length of the breakwater. For this purpose, the greatest velocity of the current must be computed, and allowing thirteen or fourteen feet in a second, for the velocity of the lateral motion of the water, the proportion between the two velocities, will give that of the length of the break-water to half its breadth. The same proportion between the projection, and breadth, of the breakwaters, should also be observed for those at the heads of piers, for reasons founded on the same principles.

Observations.—It has been well remarked that a stately bridge, over a large and rapid river, is one of the most difficult, and at the same time, one of the most justly esteemed, and striking specimens of human art. To behold grand arches, composed of an immense quantity of small materials so disposed and united together, as to form one compact body, bestriding the stream, and affording, *above*, an ample communication with the distant shores, and *below*, an uninterupted passage to navigation, is sufficient to awaken the admiration of every spectator. Every individual therefore, whose researches and experience enable him to offer important information, either in regard to the construction of these useful piles, which shall increase their beauty and magnificence, or diminish the necessary expenses of their erection, deserves well, not only of the lovers of the arts, but of the mercantile, and indeed every part of the community. For, the readiness of communication, between districts of country, which nature has dissevered by rapid streams, embraces the interest and convenience of all classes of society. The art of building bridges has, therefore, received great attention from the most eminent writers on Architecture, the earliest of whom is Alberti, who has given several judicious precepts which, with little alteration, were afterwards laid down by Palladio, Serlio, and Scamozzi. Gautier has a considerable volume on bridges, both ancient and modern. M. Belidor and De La Hire have, also, treated on this subject, and Perronet has given the result of his experience in a magnificent work, which has acquired great credit in France. Bossu's treatise on this subject is, also excellent. And on the subject of arches and bridges, advantageous reference may be made to Muller, Labelye, Atwood and Emerson; and also, to Dr. Hutton's work entitled, "Principles of Bridges."

Of late iron being the most abundant, cheap, and generally useful, of all metals, has been employed in many works, in

which strength has been required, in proportion to the weight of the material. Hence cylinders, beams, and pumps for steam engines, boats and barges for canals, and navigable rivers, beams and pillars for warehouses, and other large buildings; and, at length, bridges, have been constructed of iron. The latter are exclusively the invention of British artists. The first is that of Coalbrook Dale, in Shropshire. The second, was that which was designed by the celebrated T. Paine, with the view of being conveyed to North America, but which afterwards, as far as the malleable part of it was concerned, was wrought up by Messrs. Walker's of Rotherham, for the construction of the bridge at Wearmouth, which was the third iron bridge of importance. The fourth was thrown over the Severn at Buildwas, about two miles above Coalbrook Dale. The Wearmouth bridge gave an impulse to British taste on this subject, and produced many other examples and the inhabitants of the metropolis have reason to expect soon the convenience of an iron bridge of three arches over the Thames from the bottom of Queen Street Cheapside, for the erection of which an act of Parliament has been obtained. In pursuing the details connected with this important art, both in regard to stone and iron bridges; and, also, in offering a variety of hints for the improvements of former plans, and especially for diminishing the expense attached to the erection of bridges, Mr. Boswell has been indefatigable. Those of our readers who wish to peruse a summary display of what is important and useful on this subject will be gratified by perusing the, "Theory of Bridges"—in the Cyclopædia of Dr. Rees.

Description of a Plinth to be fixed to the bottom of Doors, to prevent them from dragging upon the Carpet; and for the interception of cold air under them, by M. CAUCHOIS.—*Repertory of Arts No* 26.

The instrument, invented by M. Cauchois, consists of a piece of flat wood of about three inches deep, the length of the door, and of any thickness that may be deemed sufficient. This piece is to be fastened to the outside of the door by means of a pair of butt-hinges, and the bottom edge of it formed to the shape, or unevenness of the floor, so that when the door is shut it may lie close. The end of this piece which is next to the frame on which the door is hung is left square. The other end must be rounded at the corner in order to allow the door to open. At the bottom of the hanging stile, close to the part in

which the bottom rail joins it, a notch must be cut about an inch deep, and of the same width to allow the door, when opened, to pass over a semi-circular wedge or staple, which is fastened on the floor on the opposite side of the door to that which the plinth is hung. It is evident, therefore, that when this door is shut the plinth will lie close to the floor; but as soon as it begins to open the plinth rises upon the semi-circular wedge, and, consequently, allows the door to pass freely over the carpet.

Observations.—This simple contrivance answers the end desired completely, and may be seen in constant operation at Mr. Rowsell's stationery shop, 31, Cheapside.

A method for constructing Girders for Buildings of short pieces of Timber, and Post and Rail Fences, stronger than those erected in the usual manner. By C. WILKS, *Esq.*—*Repertory of Arts, No.* 126.

THE method adopted by Mr. Wilks is explained by an accompanying plate, which exhibits the central section of a girder and ring-post, and shews a method of joining two pieces of timber where the span of a building exceeds the attainable length of one piece. One end of each of two pieces of timber being squared for a butt-joint, a nut is let into each from the side or top; the bolt is then introduced into one of the timbers and the nut, and turned in as far as the thread will admit. The other end of the bolt is then introduced into the other timber and nut; and the latter timber being turned as far as possible will draw the butt-joint perfectly close; and by using a plate, equal in length to the breadth of the girder, and the ring-post bolt going through that plate, it is evident the girder, although made of two pieces, can neither drop nor extend lengthwise. This method is applicable to large spans for tucked bridges, particularly if the vertical bolts go through both hand-rail post and string. Mr. Wilks has adopted a similar method for many years, in connecting long lengths of plates and purlins to roofs, giving a circular mortice, an inch deep, and tenon round the bolt to prevent its being bent when fixing. He has also adopted it in mills to great advantage, where buildings are required to be very firm in order to keep the machinery steady.

The plate also exhibits a post and rail fence much stronger than the common method, which so soon fails in the pinning and becomes useless. Each rail has a tenon, in the usual way, at one end, except that it is only three-fourths of an inch long,

and a circular tenon of the same length at the other end. A bolt is passed through the post to the nut, let into the rail, and the bolt is turned in as far as the thread is cut. The other end of the bolt is then introduced into the next rail, where the circular tenon and butt are, and the rail turned, by which means a close joint is immediately formed, on each side of the post, with the end of each rail. Any number of rails may be stump-tenoned under the top rail, without bolts or pins, it being evident that as neither the top nor bottom lines can elongate, the under rails cannot be taken out.

It is farther evident that of a number of posts, thus fixed and supporting each other, none of them can be broken in the direction of the line of fence, consequently, that the breadth of the post usually allowed for the purpose of tenoning and pinning may, by this method, be reduced to less than one-half, which saving, Mr. Wilks says, he has found to be about eight times the amount charged for the pins and nuts. He states, also, that a farther advantage is connected with this construction of a fence, in offering a great difficulty to mischievous persons and plunderers to get it to pieces.

Mr. Wilks found that a pin eighteen inches long, and three-eighths of an inch in diameter, was sufficient, and that this with its nuts will weigh about twelve ounces.

Some Account of the Methods of laying the Foundations of Bridges, &c. &c. By the Author of "Some Account of the different Theories of Arches," &c. in the Philosophical Magazine for December, 1811.—*Phil. Mag. No.* 170.

THE practice of laying the foundations of bridges in deep water, generally adopted by the ancients and moderns, has been—to lay the piers dry, either by turning the water into a new course for a time; or, by the erection of a coffer-dam round the site of the pier, to such an extent, as to prevent the water from interfering with the works, after it is once pumped out. A coffer-dam is a double inclosure of timber, consisting of piles, driven close together, and strengthened, at intervals, by larger piles and horizontal pieces. The space between the inclosures is filled with bricks and sand, or other materials, to serve the double purpose of giving weight to the dam, and excluding the water. This expense is about one-third of that, which is incurred by the erection of the piers.

Another method, more ingenious, has, also, been practised. The Emperor Claudius practised it in erecting the Port of Ostia; Draguet Reys, in erecting the Mosque in the sea at

Constantinople; and Sir Samuel Bentham is said, to have introduced it, lately, into this country, in the construction of some works at Sheerness. A strong grating of wood-work, covered with planking, at once forms a floating raft, and the floor upon which the stone pier is to be erected. The pier is composed of stones, well secured together, and by means of cement, rendered water-tight. The whole body is made to float upon the water, until it has advanced in height, so, that if it were sunk, it should be above low water mark, or higher, as might be found expedient. This levity is obtained, either by the assistance of vessels, to which the raft is attached by ropes; or by causing the pier to be constructed with sufficient vacuities, to render it specifically lighter than an equal bulk of water. The pier is then sunk, either by admitting the water into the vacuities, or by loosening the ropes, the bed of the river being previously prepared by machines, to cause it to take the ground in a level manner. If the pier should not take the ground in the way desired, it is raised, by pumping out the water from the vacuities, or by means of machinery in the vessels, and the operation is continued, until it be fixed in the ground, to the satisfaction of the architect.

Mr. Labelye, in constructing Westminster Bridge, erected the piers in caissons, or water-tight boxes—the bulk of the box producing a mass, though loaded with the pier, specifically lighter than an equal bulk of water. After each pier was erected, the sides of the boxes served again for the boxes of the other piers. There are no piles under the piers of Westminster Bridge; and only one of the foundations was found incapable of supporting its charge. Mr. Mylne adopted the same method in erecting Blackfriars Bridge, in regard to the caissons. But he piled the foundations; and, by a machine, cut off the piles level with the bed of the river.

The practice adopted in the middle ages, until modern times, was, to drive piles in the bottom of the river in the site of the intended pier, and then to cut them off a little below low water. The interstices were then filled with stone, and strong cement. Upon the piles they laid a grating of timber, covered with thick boarding, which was the floor to receive the pier; the workmen taking advantage of the times of low water, until the pier had risen to the level of high-water mark. This method is of the purest simplicity, nor does it require the aid of any machinery beyond a pile-engine. The foundation of the piers of London Bridge (as appeared when the pier was taken down in order to convert two small arches into one) was formed of a quadruple row of piles, driven close together on the exterior of the site of the pier, forming a case to receive the stone

and cement. It was not, however, ascertained, whether there were piles in the heart of the pier. For, as soon as the exterior piles were taken out, the great force of the water cleared away the remainder, and drove it down the river.

Starlings have been constructed round the piers of London Bridge, in order to protect them. They consist of an inclosure of piles driven close together into the bed of the river, and secured by horizontal pieces of timber; and the space within them is filled with chalk, gravel, and stone, so as to form a defence to the internal piles, upon which the stone piers are erected.

This writer represents the use of starlings as defective, extravagant, and absurd, tending to increase the evil of those effects which they propose to diminish. He gives the following table to exhibit the proportion of the water-ways at the three bridges in London.

	Area of the River.	Solids.	Water-way.
London Bridge	19,586	11,581	8,005
Westminster do.	19,010	4,242	14,768
Blackfriars do.	19,083	4,001	15,082

From this table, it appears that three-fifths of the water at London Bridge, is dammed up. This circumstance has caused that increased velocity of the water, and consequent increased action on the bed of the river, as to deepen it fourteen feet below its general surface. The piers have been, by this means, and are still liable to be, undermined. At the other bridges the water-way is duly proportioned to the quantity of water. The bed of the river has, therefore, remained stationary, and starlings, or any other expedients, have been unnecessary to protect the piers.

Upon whatever principle of construction the piers of London Bridge might have been formed, it is obvious, that if the same proportion of solids to water-way had been preserved, resort must have been had to starlings, or some other means, producing a similar effect. And it may justly be inferred, that if the same proportion of water-way to solids, had been preserved, as in the other two bridges, in London, the same probability of duration would have attached to it; nor would it have been necessary to have recourse to starlings.

The practice, adopted by builders in the middle ages, has fallen into disrepute, in consequence of their prejudice in favour of arcs of circles, as the forms of their arches. They seem to have been unable, or to have wanted courage, to erect arches of a great span, with a small versed sine. Where the heights of the banks of rivers have allowed them to use an arc

of a circle, with an elevated versed sine for its form, they have exceeded both the ancients and moderns in the length of the chord.

The piers of their bridges were generally numerous and their arches small, by which they rendered the ascent to the passenger more easy. Too great an anxiety for security caused them to make each pier wider than was necessary: and this surplus extent of solids became as great an evil as that which it was intended to prevent. Sufficient evidence may be brought to prove that timber always kept under water is imperishable, and that piles, if they are not undermined by an improper action on the bed of the river, possess a stability superior to that of masonry: for masonry cannot have that connection with the part buried in the soil, by which the stability of a structure subject to lateral pressure is obtained. The weight of masonry, indeed, may be considered as a substitute for the want of connection. But that weight is secured to the piled foundation by the stone-work with which our ancestors filled the interstices between the piles. If it be said that piles are exposed to the corroding effects of friction from the passage of the water and traffic, it may be answered, that this effect may be prevented by means not less simple than easy; and that it is an evil to which stone work is equally liable, and which requires equal means of prevention.

In tidal rivers an advantage attaches to the plans adopted by Claudius, and others, which does not belong to the use of coffer-dams, caissons, or the turning of the water. This advantage lies in trying each pier and foundation, previously to the imposition of the arch, by loading it with a greater weight than the intended superstructure. A vessel of such a burden may be floated over the site of the pier, at high water, and left to rest on it when the water has ebbed. The Author concludes by the following remarks:—

It is due to those whose public virtue leads them to adorn the metropolis. and to increase the advantages which so eminently belong to it, that their labours, obviously disinterested, should be attended with the least possible expense. Their attention, therefore, is particularly required to the modes above described; in order that they may determine whether they should adopt the expensive methods of turning the course of rivers, or the use of coffer-dams, methods attended with certain success, even under the management of ordinary talents: or, whether they should adopt the cheap methods of the Emperor Claudius, or St. Benezet; but for the due execution of which greater abilities and judgment are required.

Observations.—This account being confined to a short narrative, in detailing which the Author proposes no plans for the improvement of the old, or the formation of new methods of laying the foundations of bridges, we have only to remark that the cause of the failure of the arches of Westminster bridge was not owing, we believe, to any defect in the method, but to the improvidence of ballast heavers having excavated the gravel contiguous to the pier, immediately under the arch, so as to weaken the natural foundation.

Description of a new Thrashing Machine. By R. TAWNEY, *Esq.—Phil. Mag. No.* 172.

THIS machine is to be wrought by two men, with each a winch upon the axis of a wheel, which, by means of a small rope, turns a pulley fixed upon the axis of the drum. The wheel is hung upon friction rollers, and it was Mr. Tawney's intention to have put rollers to the drum axis; but as these were found to enhance the price, and by this means defeat the general utility of the plan, the latter were omitted, and the friction diminished by making the brasses and the axis as perfect and as small as they could be made consistent with safety.

The drum, rollers, and plates, are constructed upon the principle of the machines made by Mr. Wilson, of Leicester, which for quantity and goodness of work are preferred, by Mr. Tawney, to many others which he had examined. In these machines the rollers for feeding are placed horizontally, and are supplied by laying the corn upon a board inclining to them from the top. One roller is turned by a small strap from the axis of the drum; and as the two are made to touch by a thin well turned iron wheel or flanch at each end, the other roller is moved by friction. Here it must be remembered that as the wheels are small the points of contact are trifling, and that no means of obtaining an equable motion are so good.

The axis of the second roller is hung at each end upon a pivot, so that when the feed is too great the roller will open and be brought back again by a weight suspended at the end of a small lever.

The drum is made open and the beaters fixed upon a ring at each end. Mr. Tawney observes, that his machine is much improved by giving the drum a fly-motion. The rings are made thin and with little wood, and the beaters are of bar iron. He conceives, however, that the more simple way would be to make the rings of cast-iron, and throw the weight to the rim.

The leading feature of Mr. Wilson's machine is the situation

of the parallel ribbed plates, against which the corn is beaten or rubbed. Compared with the other machines they may be said to be divided. One part is fixed to the levers which carry the feed-rollers, and the distance of which is regulated by a screw through the top of the frame. The other is fixed in the frame which carries the iron grating, and with that the distance is regulated by a screw at each corner.

It is plain that the straw, after passing the first plate, may take a different direction before it enters upon the second plate and grating, and to this circumstance Mr. Tawney attributes the superior working of the machine. By placing the feed-rollers so far from the ribbed plate and beaters the straw is not broken, but will admit of being tied up in boltings as well as if thrashed by the flail.

The great wheel of this machine is six feet six inches in diameter. To avoid resistance from the air it is but two inches in thickness, and the spokes are made elliptical. In order to give it a fly-motion fifty-six pounds of cast iron are added to the ends of the spokes. This weight is sufficient to lead the men on, so that the difficulty is not to keep them up to a certain number of revolutions per minute, but to dissuade them from doing too much.

The pulley, hitherto worked upon the drum, has been either one-eighth, or one-tenth of the diameter of the wheel. And as in working, the former is lighter, it was found that the velocity of the hand increased in proportion. The minimum velocity of the hand is forty revolutions per minute; and this carries the drum through a greater space than that of any ordinary machine of two, or four-horse power.

The winches at first were made to describe a circle of thirty-six, but were subsequently shortened to one of thirty inches in diameter.

The rope is of the best tarred kind, one inch and a half in circumference, and spliced together.

The carriages of the wheel are fixed to the frame by two screw pins, and the variation of the rope is remedied by slackening the nuts.

Mr. Tawney is not prepared to state what this machine will thrash when corn yields well. It has been tried, he says, with the worst of every sort of grain, and thrashed it perfectly clean.

With the labour of two men it thrashed wheat of the season of 1811, from thirty to thirty-six bushels (eight and a half gallon measure) per day, which will warrant an expectation of considerably more in a good yielding year. In wet weather Mr. Tawney found it exceedingly useful to employ his men on

those days when nothing out of doors could be done. And although he admits that with a winch it may not be quite applicable to the case of a very large farmer, yet he is fully persuaded that a considerable part of the farming interest will find it of real advantage as an auxiliary, if not a principal machine; and to the small occupier he confidently recommends it as the most effective hand-machine yet in use.

Observations.—In the preceding volumes of our work we have been so repeatedly called upon to give an account of Patents and Plans, and Hints, for the formation of Thrashing Machines, that, without intending to disparage the ingenuity or utility (terms which we really think appropriate) of Mr. Tawney's new machine, we apprehend we cannot perform a more acceptable service to our agricultural readers, than by enabling them to take a comparative view of their respective merits, which we offer through the medium of the following list of references to the Inventions, which have already passed before us, added to our occasional remark:—Volume I. page 78; III. p. 473; IV. p. 141, 256, 300; V. p. 214, 219, 262; VI. 84, 504, 419, 457.

Observations on the Etherial Oil which gives the bad flavour to Corn-brandy. By MM. KOERTE and GEHLEN.—*Ann. de Chim. tom.* 81.

SCHEELE first remarked that weak corn-spirit becomes milky when exposed to intense cold, and then deposits a white sediment which, when warmed in a spoon, melts like an oil, and when dissolved in pure French brandy gives it the peculiar and unpleasant taste of recent corn-spirit; whence, this eminent chemist concludes, that this oily matter is a product of the fermentation of grain.

The separate experiments of M. Koerte, and M. Gehlen, give further properties of this oily matter. It is obtained in the first distilled product of the wash from fermented grain, rendering it milky, and gradually separating on the surface. The taste is unpleasant and nauseous. When exposed to the atmosphere it gradually evaporates, diffusing its unpleasant smell all around. It gives grease spots on paper which disappear on warming. It is scarcely, if at all soluble in water, but dissolves in alcohol. When digested with caoutchouc at the temperature of about 86, Fahr. it softens it so completely as to make it settle at the bottom of the vessel like an ointment. Sulphuric acid heats, coagulates, and blackens it. Nitric acid

heats it, gives it a golden red colour, and converts it to an acrid butyraceous mass.

To these facts, relative to this singular oil, M. Gehlen adds the following:—It was obtained by digesting, in boiling alcohol, the woollen strainers through which the first products of the distillation were poured. The alcholic solution saturated when hot deposits part of the oil in cooling, in the form of crystalline scales. The specific gravity of this oil is such that it swims on proof spirit, but sinks in rectified alcohol. The latter dissolves about a sixth of its weight of this oil at a moderate temperature. Rectified ether disolves half its weight. The oil itself readily crystallizes in cooling after having been melted in water. When the oil is long digested with a weak potash-lye it changes to a bulky soapy mass soluble in a good deal of water, but which stiffens on cooling. The hot solution becomes milky by muriatic acid and retains the original nauseous smell. The most probable idea on the formation of this oil is that it is a product of the fermentation of grain.

Memoir on the Manufacture and Use of Archill. By Mr. Cocq, *Ann. de Chim. Tom* 81.

The lichen that produces the Archill is found abundantly growing to the volcanic rocks about Auvergne, and the gathering and subsequent preparation of this valuable dying material is the sole occupation of a number of persons who take pains to conceal as much as possible the whole process. Nevertheless Mr. Cocq asserts that he has been able to acquire an exact knowledge of every important particular which he has given in the present memoir.

There are many varieties of lichens growing on these rocks, but of these, only one will give the beautiful violet-purple dye in question, and this is called in the country *Parelle*, but is not the *lichen Parelles* of Linnæus, but the *Variolaria orcina*. This lichen requires three years to come to the proper size and thickness for gathering, and it improves in size and quality to the sixth year. It is cut with a short scythe blade of soft iron or rather a crooked hoe fixed at the end of a stick, the blade being rather moveable, as it is soon blunted by use and requires to be sharpened again. In a days work a gatherer will blunt and charge as many as thirty blades. The lichen is gathered by men women and children during the winter season only and rainy weather is preferred as the plant is then easier separated from the rock. An active skilful person can

gather about four pounds daily. To find whether the lichen gathered is the proper sort for yielding the dye, a little of it is put into a glass, moistened with urine and a little slacked lime added. The good lichen will turn brown, but the other sorts will become yellow or green. The lichen is then carefully shaken on a sieve to exclude as much as possible any earthy matter adhering to it.

As this plant is chiefly collected in the winter season much care is required to dry it, otherwise it would readily ferment and spoil. It is dried by being spread thinly on a floor and often stirred. It is also freed from the moss adhering to it by being laid out and rubbed with a course woollen stuff, the nap of which entangles the moss and carries it off. The lichen thus cleared and dried is further prepared in the following way: 100 killogrames (about 220 lbs) of it are laid in an oblong wooden trough and moistened with about as much urine (or more, if the lichen is of very strong quality) and a cover is closely fitted to it. Every three hours for two days and nights the contents of the trough are well stirred together: and on the third day 5 killogrames of sifted and slacked lime $\frac{1}{4}$ killograme of powdered arsenic, and as much rock alum are added. Its fermentation begins in the trough in about two days and it is the great art of the workmen to keep it up to the proper point, by frequent stirring, and particularly to be constantly breaking down a hard crust which rises to the top and would impede the fermentation. Sometimes when this goes on but slackly about one killograme more of lime is added; after two days it seems necessary to bring out the colour of the lichen completely, that the contents of the trough should continue to work for a whole month, during the whole of which time the stirring is repeated, but with diminished frequency. The inferior quality of lichen does not require so long a fermentation as the best sorts. The mass thus prepared is called archill *(Orseille)* and when complete, is stowed in casks where it will keep for years and it even improves during the first year, but after the third its quality begins to alter for the worse. When in casks it should be moistened from time to time with urine to prevent it from drying up, and it gradually acquires an agreeable violet smell. The best kind of Archill melts down entirely in the dye boiler when used. That of the Canaries is preferred as being cleaner and freer from sand and earth. This inconvenience is prevented by washing the lichen in urine (not water, as this would make it too difficult to be dried) as soon as collected.

The colour given by Archill is very fugacious by itself and is seldom or ever used alone; but its great use is to heighten

and enliven the tone of colour given by the indigo-vat. In this way a stuff only twice dipped in the indigo-vat and then finished by being turned over the winch in an Archill-bath acquires as fine and bright a colour as it could have by any subsequent passing through the indigo, and at much less expense. The colour of the Archill might probably be freed by the solution of tin without the use of any other dye, but this is never so employed.

Analysis of Egg Shells. By M. VAUQUELIN.—*Ann. de Chim. tom.* 81.

EGG shells have usually been considered as consisting merely of carbonate of lime, with a little cementing animal matter, but the author, in examining them with his usual accuracy of observation, has also detected a small quantity of carbonate of magnesia, of phosphate of lime, of oxyd of iron, and a little sulphur. Of two modes of analysis which he gives, the simplest is the following:—Dissolve as much as possible of the shell in muriatic acid, which is a long process on account of the tough form produced by the animal matter entangling the carbonic acid. Evaporate the solution to dryness, calcine it slightly, and then redissolve the soluble part in water, by which a grey powder will be left consisting of phosphate of lime. Supersaturate the solution with ammonia, which gives a yellowish precipitate. Wash this, redissolve it in sulphuric acid, evaporate to dryness, and calcine strongly to expel the excess of acid. Add cold water to the residue, which will dissolve out the sulphate of magnesia, and will leave the sulphate of lime and a little red oxyd of iron, and evaporate the solution till the sulphate of magnesia will crystallize by cooling.

If the shells are first coloured, the addition of an acid will give a very sensible smell of sulphuretted hydrogen, shewing that the sulphur which they contained has united to the lime.

Analysis thus shews the presence of carbonic and phosphoric acid of lime, magnesia, and sulphur in egg shells.

The inner membrane of the shell appears to be of the nature of allumen, as it dissolves readily in caustic potash without giving out ammonia. Acids separate the animal matter from this solution in white flocculi, also resembling allumen, and with the odour of sulphuretted hydrogen.

Not the least trace of uric acid was found in egg-shells, though this was carefully looked for in the analysis.

Oyster-shells contain the same constituent parts as egg-shells, but the magnesia is in much smaller proportion.

French Patent granted to J. F. Boby, for making Glue from materials not before used for the purpose.—Repertory of Arts, No. 135.

THE material here employed is *bone.* The bones of every species of animal are taken and first bruised to powder, in cast iron mortars; this powder is put with a little water into a copper boiler, and made to boil for twelve hours successively: the liquor clarifies as it cools, the materials are boiled again with fresh water, and the liquid, after being strained through cloth bags, is added to the first solution and the whole is evaporated by a slow fire till it has got the consistence of syrup, after which it is run into tin moulds, where it compleatly solidifies into glue, which is slowly dried in the air in the usual manner.

Observations.—A late excellent French chemist M. Pelletier, has given the history of this method of extracting glue from bones, and, together with M. Parmentier, has added the particulars of some valuable experiments on this subject. It appears that Papin was the first who suggested the advantage of this process, and in his work describing his Digester, published in 1682, he states, that he has extracted from bones and from ivory, a strong jelly, with which he was able to join broken glass very firmly. After Papin, Spielman has added much on this subject, having prepared a very strong glue from a great variety of bony matters, and in particular one from the jaw bones of the pike was so tenacious, as to bring off the glazing when separated from the plate on which it was dried. In 1792 M. Grenet, a French manufacturer, found that a very firm glue, almost equal to the best English glue, could be made from bones merely by long continued ebullition, without the assistance of a digester, or any similar vessel. The materials which he found most to his hand, were, the raspings and clippings of button-moulds, knife-handles, and other articles of bone, being already cleansed and dried. M. Grenet's process was repeated in the laboratory of M. Pelletier, in 1792, and as it is important we shall give it here: Six pounds of raspings of button moulds were put into a copper boiler, with 24 quarts of cold water, and allowed to soak for two days. The fire was then kindled, the liquor made to boil, and kept so for nine hours and the materials were then kept in the boiler undisturbed, for a night, during which the liquid became clear by the subsidence of the undissolved part. The next day 14 quarts of a clear solution of bone jelly were drawn off with a syphon, and the residue pressed through a strainer gave two quarts more. This jelly

was then reduced by evaporation as much as was judged proper, and when cooled was put into boxes in which it stiffened to a very strong jelly in a day's time. The jelly was then cut up into thin cakes or sheets, and hung up on threads in a dry room and in a fortnight (the weather being wet the whole time) they became good strong glue. The products of the 6lbs of button-mould raspings were 15 ounces and a half of fine glue, half an ounce more of inferior quality from the strainings of the undissolved residue, and 4lbs three ounces of this residue, making a loss of thirteen ounces, on the entire 6lbs of bone.

Ivory shavings gave nearly similar results, but the glue was higher coloured, and in drying became covered with a saline efflorescence, which was attributed to the saline matters used to soften the ivory by the workers of this article.

French patent granted to Messrs. BOUCHERIE *for a Method of Refining Sugar.—Repertory of Arts, No.* 137.

Two processes are described by the Patentee as improvements upon the common mode of manufacturing sugar.

The first process is the following:

The raw sugar is taken, without being dissolved, and deposited in square cases, the bottoms of which are made of basket work, which may at any time be removed and cleaned. These are filled with the raw sugar fifteen inches in height, and covered with wet clay in the usual manner. The water from the clay filters through the sugar and carries down a syrup, which is received into tubs or cases lined with tin, and which by a mild heat furnishes an abundant crystallization. The crystals taken out and separated from the mass, are purified in the same manner as the raw sugar, which is then as white as the clayed sugar in common use in the French colonies.

In the second process the clayed sugar is dissolved in water and clarified with white of eggs solely, (instead of lime-water and bullock's blood) and is then evaporated in flat shallow boilers, at a heat which hardly exceeds that of boiling water, after which it is poured into moulds to form loaf sugar, which are clayed, and stored in the usual manner.

The Patentee claims two variations from the common mode of proceeding, one of them is the claying the raw sugar without previously dissolving it; and the other is the slow evaporation, at a heat much below the usual temperature of boiling sugar.

The Patentee however, lays by much the greatest stress on the first process: he asserts that by this means the raw sugar is

so completely purified, that the slow evaporation is unnecessary.

But, the whole of the specification here given is so confused and imperfect, that it is not easy to make out what the Patentee's invention really is.

Analysis of Squills. By M. VOGEL.—*Ann. de Chim. tom.* 83.

THE expressed juice of the squill (or sea onion) is milky, bitter, and slightly reddens litmus. The juice when filtered and boiled gives no precipitate, and hence contains no albumen. When distilled first it gives a clear tasteless water, which differs in no respect from pure water, and hence the acrid principle, which is peculiar to the squill, is either not volatilized with water, or is destroyed at a boiling heat.

The expressed juice, when much concentrated, deposits in cooling a quantity of fine needled crystals of citrate of lime. The remaining liquor evaporated to dryness gives a brown extract, which alcohol dissolves one portion, leaving behind a tasteless gum. The alcoholic solution contains tannin, and a peculiar matter, of a most intensely bitter taste, equally soluble in water and spirit, and appearing to possess in a peculiar degree the active medicinal properties of this valuable root. The medicinal tincture and vinegar of squill is known to become turbid when kept for some time, and deposit a viscid matter. This, when analyzed, is found to consist chiefly of tannin and citrate of lime.

Observations.—The analyses of all the vegetables that have active medicinal properties possess a peculiar interest from the attempts to insulate that part, in which these properties, particularly reside. M. Vogel appears to have had some success in this respect, in his treatment of the squill.

Analysis of a new variety of Antimonial Ore. By M. VAUQUELIN.—*Ann. de Chim. tom.* 83.

THE specimen here analyzed was sent to M. Hauy, from Westphalia, being the produce of a mine newly opened, near Treusbourg in Nassau, and as containing the hitherto unknown combination of nickel and antimony. This specimen had been already examined by M. Ullman, and by Klaproth, who gave its composition to be antimony, nickel, iron, and sulphur. Its external characters and properties are stated by M. Vauquelin,

to be the following: It consists partly of large parallel laminæ of a brilliant white colour, and partly of a compact slightly splendent matter of a leaden grey colour, covered with a yellow crust, resembling oxyd of iron. Its specific gravity is 5.65. Under the blow-pipe it melts and gives white arsenical vapours, and also gives a yellow stain to charcoal, but as these escape the fusibility diminishes, and at last a white brittle button remains; these appearances indicated both arsenic and antimony. The ore was then analyzed by nitric, and muriatic, acid separately. The particular steps of the process, we shall not give, but the results were that the ore is a compound of antimony, nickel, arsenic, sulphur, iron, and lead, and in this order of proportional quantity, the antimony forming nearly half the weight. The following observations are added by M. Vauquelin: It is a difficult question to resolve the mode in which these ingredients are combined. It may be supposed with some probability, that the antimony and sulphur form one definite compound, the arsenic and nickel a second, and the iron and nickel a third; and that these three compounds are only mechanically combined with each other, to form the entire mineral. What adds weight to this opinion is, that some portions of the mineral are highly fusible, and others but little so. Nevertheless when gently heated in a retort, it gives a little orpiment, and a very brilliant fused homogeneous mass remains. The only other known combinations of nickel is with arsenic; and antimony is generally found united with sulphur. An exact analysis of this ore would be very difficult, for want of a good method of separating arsenic from antimony, for by the action of nitric acid, the arsenic becomes acidified, and insoluble arseniats of iron and antimony are produced, which cannot be again decomposed by adding acids or alkalies. These arseniats are soluble it is true in muriatic acid, but on adding water to separate the antimony, this carries down with it most of the arsenic, and only arseniat of iron remains in the solution. An arseniat and a sulphat of nickel, are also formed in the nitrous solution, by the acidification of arsenic and sulphur, and thus the arsenic acid divides itself between the three other metals.

Memoir on the Formic Acid. By M. GEHLEN.—*Ann. de Chim. tom.* 83. *(from the German.)*

M. GEHLEN, first gives a history of the various opinions held by different chemists on the acid of ants, particularly on its specific nature which has been much questioned by many, and in particularly by Messrs. Fourcrog and Vauquelin, who exa-

mined it in 1803, and concluded it to be a mixture of acetic and malic acids, which latter they have since concluded to be the phosphoric.

M. Gehlen extracts the pure formic acid by the intervention of copper in the following way: the juice expressed from ants is supersaturated with potash, and then added to a solution of red sulphate of iron. The yellow liquor thus produced is evaporated to the consistence of a syrup and distilled with sulphuric acid. The distilled liquor is very acid, but contains no sulphureous acid. This is saturated by carbonate of copper and the solution gives by evaporation blue crystals of *Formiate of Copper*. Thirteen ounces of this cupreous salt were distilled in a retort, with eight ounces and three quarters of concentrated sulphuric acid, and the product was again rectified, and a pure acid liquor was obtained, of a sour pungent taste, remaining uncongealed at a very low temperature, of 1,1168 specific gravity, (which is higher than that of acetic acid) and when distilled with alcohol forming a fragrant ether, with a decided smell of peach-flowers.

The formiate of copper, compared with the acetite shews the following marked points of difference: It is lighter than the acetite, more soluble in water, and scarcely soluble in alcohol, whereas the acetite dissolves in twelve parts of this menstruum.

When the formiate of copper is distilled by itself, it melts and the water of crystallization first passed over, after which a pungent weakly acid liquid follows rather suddenly, and a red spongy residue of pure metallic copper free from carbon remains in the retort. On the other hand the acetite of copper distilled by itself does not liquefy but rather decrepitates and the cupreous residue always contains charcoal.

The *Formiate of Barytes* forms very transparent and remarkably brilliant crystals, unalterable in the air, whereas the acetite of barytes rather effloresces. This formiate contains much more base than the acetite.

The remainder of this memoir will be given at another opportunity.

New Researches on the Nature of the Liquid obtained by the Mutual Action of Sulphur and Charcoal. *By* M. CLUZEL. *Ann. chim. Tom.* 84.

A Report on the above Memoir of M. CLUZEL. *By* MM. BERTHOLLET, THENARD, *and* VAUQUELIN.

THE subject of this long and elaborate memoir of M. Cluzel is that singular liquid first discovered by Lampadius in 1796,

by distilling martial pyrites with charcoal, and to which he gave the name of *alcohol of sulphur*, and considered it as a compound of hydrogen and sulphur.

Messrs. Clement and Desormes some years after obtained the same liquid by passing the vapour of sulphur over well-dried charcoal, in a red-hot porcelain tube, and considering it as a simple compound of carbon and sulphur, they termed it *carburetted sulphur*.

Afterwards M. Amadeus Berthollet, in a very elaborate series of experiments on this substance, was led to suppose it a compound of sulphur and hydrogen, and denied the presence of carbon.

In the present memoir M. Cluzel, after a very long series of experiments, is led to infer the composition of this singular fluid to be carbon, hydrogen, azote, and a hitherto unknown substance, the *radical* of sulphur, or that substance which he supposes to become common sulphur when united with one proportion of oxygen.

This liquor may be easily prepared by mixing pyrites powdered and dried to expel all the moisture, with twice its weight of powdered charcoal previously ignited by itself in a covered crusible for a considerable time in a very strong heat to expel all the water which adheres so obstinately to charcoal. This mixture of pyrites and charcoal is to be put into a good earthen retort, to which is luted an adopter proceeding to a glass matrass kept surrounded with ice, and with a small curved tube to carry off the gas which is generated. On heating the retort very strongly much gas is expelled, and the liquid carburetted sulphur in question is condensed in the cold matrass.

The properties of this liquid, according to M. Cluzel, are the following: It is a perfectly limpid colourless fluid, highly volatile at a very moderate heat (in which respect it equals the best ether) rather heavier than water, of a very arid burning taste, and a very penetrating and quite peculiar fetid sulphureous smell, but entirely differing from that of sulphuretted hydrogen. It is but little soluble in water but highly so in alcohol, and the alcoholic solution therefore becomes milky when dropped into water. This milkiness is not owing to any decomposition of the carburetted sulphur, but merely a separation of it from its spirituous solvent. It burns with a white flame, blue and occasionally red at the edges, and in burning it emits a strong sulphureous smell. It leaves no carbonaceous residue but only a very minute proportion of sulphur.

M. Cluzel attempted the analysis of this singular liquid by passing it over heated copper. Copper wire was introduced into a varnished porcelain tube with a small retort holding some

of the liquid carburetted sulphur at one end and an adopter and tubulated matrass at the other. The liquid was heated and its vapour gradually passed over the copper, made red hot in the tube. No gas was produced, and only a portion of the liquid was decomposed, the remainder condensing at the other end of the apparatus somewhat altered in appearance, being of a rose colour, very arid and volatile. The copper when withdrawn was brittle and covered with a black matter resembling charcoal. By further analysis it was found to be a sulphuret of copper mixed with charcoal. The copper had gained from one eighth to one sixth in weight by the process, and the weight of the brittle copper and sulphur in the tube, added to that of the liquid condensed, equalled the quantity of materials employed to about one fiftieth of the whole.

As the author could not decompose the whole of the liquid by this method he attempted it by detonating it with oxygen in Volta's eudrometer. But as the expected results might give carbonic acid and sulphureous acid gas, it was necessary to find some accurate method of separating these two gasses. This is often done by water, which absorbs the sulphureous acid copiously, and carbonic acid sparingly, but this way is obviously inaccurate. It has also been done by precipitating both with lime-water, when the sulphate of lime thus produced will not effervesce with sulphureous acid, but the carbonate of lime will. But this way is also incompetent to separate the two salts accurately. M. Cluzel has found that these two gasses may be very accurately separated by black oxyd of manganese and especially borax. The oxyd of manganese absorbs sulphureous acid gas with extreme ease and rapidity. It also does indeed absorb carbonic acid, but not totally till after several days, whereas the former gas is taken up in a few minutes, but with a small mixture of carbonic acid when both are present. On the other hand borax appears by M. Cluzel's experiments to answer the purpose of separation most completly, nothing more being necessary than to confine the mixed gasses over mercury with a few bits of borax and in an hour's time all the sulphureous acid gas is absorbed and all the carbonic acid left behind.

To detonate the liquid carburetted sulphur, a little of it was put in contact with dry and pure oxygen by which the gas became saturated with the vapour of the liquid, and nearly doubled in bulk. This gas thus prepared was transferred to a dry detonary and exploded by the electric spark. The explosion is extremely violent, so as strongly to recoil on the hand that holds the tube, and also requires the tube to be unusally thick. The whole of the vapourized liquid is

not consumed in this way but part of it condenses, and M. Cluzel found that to prevent this it was necessary to mix one part of the oxygen holding vapour, with two parts of simple oxygen before the whole would detonate without leaving any visible solid residue. After this, the sulphureous acid was absorbed from the gasseous residue, by borax, and the carbonic acid by liquid potash and the unabsorbed gas estimated.

The same mode of analysis was repeated, but with atmospheric air instead of oxygen, which was previously saturated with the vapour of the liquid.

We shall not follow the variety of calculations given by the author from a great number of experiments, but the singular deduction from them is that the charcoal and sulphur, if estimated from the allowed composition of carbonic and sulphureous acid, would, when added to the hydrogen of the water produced, sensibly exceed the weight of the alcohol of sulphur employed. Hence M. Cluzel concludes that sulphur or charcoal or perhaps both, are not simple bodies, but oxyds in a low state of oxygenation, and that they exist in their simple state in the liquid carboretted sulphur here analysed, but he prefers considering only the sulphur in this state. Besides the *radicals* of sulphur, carbon, and hydrogen, the author also finds a small proportion of azote, and he gives the following as the general composition of this liquid, viz.:

Carbon	28,49
Hydrogen	5,86
Azote	6,08
Radical of Sulphur	58,67
	100,00

The report in the foregoing memoir made by Messrs. Berthollet, Thenard, and Vauquelin contains (along with a deserved approbation of the great care and chemical skill shewn by M. Cluzel) several remarks on the extreme difficulty of coming to a satisfactory conclusion where so many and such various delicate precautions are to be taken at every step. These gentlemen also give the result of some experiments which they made on the same subject.

Through 55 grammes of copper made red-hot in a porcelain tube they passed 23,135 grammes of the liquid carboretted sulphur reduced to vapour by a gentle heat; 4 gs. of the liquid escaped decomposition and was condensed of a yellow colour in a vessel surrounded with ice attached to the further end of the tube. The only gas disengaged was the air in the vessels, saturated with the vapour of the liquid, and containing an atom

of the carbonic acid. This air burned with a blue flame like the liquid itself; and the result of the combustion was a gas that precipitated lime-water in flocculi, and smelled of sulphureous acid gas, but did not blacken acetite of lead, and, therefore, contained no sulphuretted hydrogen. The tube contained, after the operation, a sulphuretted copper, black and shining, and apparently crystallized, and it appeared entirely homogenous in every part. This sulphuret of copper weighed 7.2 gr. and had, therefore, encreased 17 gr. in weight, and this 7.2, added to $4\frac{1}{2}$ of the undecomposed liquid, gives the total weight of all the materials employed, excepting 1.6 gr. which may be attributed to the vapour of the liquid wafted away along with the air of the vessels. The $4\frac{1}{2}$ gr. undecomposed liquid was then passed in vapour over fresh copper, and was now entirely decomposed, so that no gas or deposit whatever appeared in the cold extremity of the apparatus. Hence, it is inferred, that if the copper is in sufficient quantity, and the vapour of the liquid be passed over it very slowly, not a particle of the vapour will escape decomposition, and, therefore, by the analysis of the black sulphuret of copper, the product of the operation will be discovered all the constituent parts of the liquid. For this purpose 10 grammes of this sulphuret were heated with nitric acid, which separated the metal, leaving 1.31 gr. of a black substance. This latter was then sublimed in a vessel (filled with carbonic acid to prevent its combustion) and yielded flowers of sulphur, leaving behind 10.34 gr. of a black matter, which burnt like charcoal without any sulphureous smell, and left only a minute residue of copper. The nitric acid employed to separate the copper was found to produce no carbonic acid, as the nitrous gas arising during the solution did not disturb barytic water. The sublimed sulphur being collected from the black carbonaceous residue, and the sulphur contained in the sulphuric acid produced in the nitrous solution being added (from Berzelius's data of 41 per cent. sulphur in sulphuric acid, and 34 per cent. acid in sulphate of barytes), the entire amount of the sulphur was very little short of that which is contained in the common artificial sulphuret of copper; and, besides, the amount of this sulphur and of the charcoal obtained equalled, within a small fraction, the whole weight by which the copper had increased.

These experiments have led the Authors to conclude that this singular liquid is a simple compound of about 14 or 15 per cent. of carbon, and about 85 to 86 of sulphur, without either hydrogen or azote, or, in other words, that it contains six parts of sulphur to one of carbon, and, therefore, the term *liquid carburetted sulphur* is quite correct.

AGRICULTURE.

On Planting Oaks;—by HENRY ANDREWS, Esq. Trans. *Society of Arts Vol 29.*

This gentleman planted on an estate in Lincolnshire, 22,000 oaks in the space of two years on a soil of a very deep sandy nature, and not calculated to pay the expense of tillage. The plantations were fenced with a very thick and high sod wall, and were made in 1809 and 1810. In the former year twelve thousand of the oaks were planted in February and March among other forest trees in a plantation of about 37 acres; and the remaining ten thousand oaks were planted in 1810 in the like manner in a plantation of 42 acres. The whole of the trees planted in these plantations was 218,760; of which the greater part, besides the oaks, were Scotch and Spruce Firs, and Larch. Certificates are annexed to the communication proving the thriving state of the plantations.

Observations.—While planting of timber is at once attended with both profit and honorary distinctions (the Society of Arts confered their medal on Mr. Andrews) we shall hope to see all disrricts which are unfit for Agricultural purposes, rendered useful to the public by the production of timber.

On Planting Larch Trees; by WILLIAM CONGREVE, Esq. *Trans. Society of Arts.*

After stating the flourishing condition of former plantations for which he had received the medal from the Society, Mr. Congreve proceeds to state that since January 1808, he had planted 684,560 Larches upon one hundred and ninety acres of poor flinty heath land in the parish of Mortimer. Some of the plants used were seedlings, which came from Scotland, several thousand of which were lost from being heated during the long passage, the rest of the Larch were purchased from a nursery near home, which were found to contend with the heath far better than the seedlings from Scotland. The trees were planted at three feet distance from each other in rows at the same distance in holes made with a pick-axe at the time of planting; and the roots of the plants were carefully covered and troden down.

Observations.—The great value of Larch trees as timber is too well known to require any illustration, and no gentleman has more benefited his country in this way than Mr. Congreve of Aldermarston.

Description of a Dibble for planting Acorns in the midst of bushes and thickets. By Mr. CHARLES WAISTELL. *Trans. Society of Arts, vol 29.*

There is some difficuly in making this description quite intelligible without the assistance of the plate, which accompanies the original communication, it consists of two tin tubes of about three quarters of an inch diameter soldered the one upon the other; the first perfectly straight, and the other bent at the lower end and inserted into the first. A strong iron dibbling rod is thrust down the straight tube to make the hole in the ground, which is then withdrawn above the hole of communication from the other tube; down this tube the acorn is conveyed, and falls into the first tube and then into the hole in the ground made by the dibbling rod; and is there covered over by two small wings of iron fastened to the tube. The instrument may be made of any length required to thrust into bushes and hedges.

Observations.—Thorn bushes and hedges being the natural protectors of young oak timber from the depredations of cattle of all kinds, acorns may be deposited by this implement in the situations best fitted for their growth, particularly in Forests, Commons, and open Pastures. Its importance then must be admitted, since there is a greater or less proportion of almost every estate, which would pay the proprietor much more, if judiciously planted, than any rent to be obtained from a Farmer.

Account of the Culture and Preparation of Hemp in Dorsetshire. by H. B. WAY, *Esq.—Trvns. Society of Arts, Vol. 29.*

Mr. Way, having learned that the Society of Arts were anxious to procure information as to the best modes of cultivating hemp in England, communicates his own practise, which had been altogether successful. He states that his hemp is usually sown about the 15th. of May on the best arable land, on which about twenty cart loads of a ton each of good rotten

dung had been previously spread, to the acre; this is ploughed in, and the ground well ploughed two or three times, and well dragged and harrowed to get the soil as fine as possible, and about two or two and a half bushels of seed sown to the acre; the male or summer hemp is drawn about five or six weeks after the plant comes up; it is at that time in blossom; and when drawn it is tied up in bundles and carried to some meadow land and there spread to ripen; when ripe and dry, it is bundled and stacked. What stands for seed is the female hemp, which has no flower that can be discovered, and is generally ripe early in September, when it is drawn, bundled up and stacked up in the field for the seed to dry and harden; after which it is thrashed out. The seed is commonly sold in Dorsetshire at from 2s. 6d. to 7s. per bushel on the spot; and an acre of hemp produces eighteen or twenty bushels. When thrashed the hemp is carried to the meadows, and spread to ripen as the other, and stacked in the same way to prepare it for sale. It is sent to the houses of the poor in the parishes, near which it is raised, to be what is called scaled, that is, each separate stalk of hemp is broken in the hand, and the hemp, which is the outside rind or bark, is stripped of, in which state it is sent to market. The scaling is the employment of old men women and children, and of the whole of the labouring family in the evening, as in winter they make but poor wages of it, and one principal inducement for them to undertake itis that the woody parts of the hemp make them a fire. The expense of this operation is considered a drawback on the cultivation of the article. An acre of hemp in a good season is stated to produce from 14 to 18 *weights* of thirty two pounds each; and the price of a *weight* of hemp is given at from 16s. to 20s. The rotation of crops is 1. hemp, on ground well manured; 2. wheat.; 3. barley or oats; 4. clover; 5. wheat; 6. barley or oats; and then manure again for hemp; though sometimes hemp is obtained every third crop by plentiful manuring.

The quantity of hemp sown in Dorset is mentioned as very trifling in comparison to what is sown in Somerset, being in the former county confined chiefly to eight or nine parishes; but it is not in either county ever sown on ground fresh broke up, which is always preferred for flax, wherever it can be obtained. A change of hemp seed is considered necessary, and is much wanted in Dorset and Somerset, and attempts have been made to procure it from Russia, but it is not easy to get new seed early enough from that distant country; and it is suggested that an attempt should be made to procure it from the Black Sea or from Italy. The most preferable manure for hemp is thought

to be good rotten stable dung, though lime is frequently used; or manufacturers pretend to assert that they can distinguish a material difference in the quality of the hemp, where lime has been used instead of dung, as from lime they say hemp is more harsh and brittle, and not of such a soft silky quality, as where dung has been used. The writer concludes by saying, that, though he is no farmer, his statement may be depended upon, as he has endeavoured to throw together every thing that has occurred to him on the subject of the culture of hemp in the County of Dorset, of which he is a native; and expresses that he shall feel the most heartfelt pleasure, if he can in the smallest degree assist in promoting the growth of an article so essential to the welfare and prosperity of the kingdom.

Observations.—The culture and preparation of hemp in England, has been hitherto confined within so very narrow a compass, that it became desireable the process should be more generally known. This communication from Mr. Way will, in our opinion, contribute to that effect; an effect which may render us more independent of foreign powers, for an article so essentially necessary for our navy.

Some particulars regarding the Farm occupied by J. C. CURWEN, *Esq. of Workington Hall in Cumberland, with remarks on the improvements of which* Mr. CURWEN'S *system is susceptible; by* Sir JOHN SINCLAIR, *Bart. Farmers Mag. No.* 53.

The land occupied by Mr. Curwen, is stated to consist of 973 acres, of which only 50 consist of loam or gravel; the remainder is strong clay on a retentive subsoil; and this quantity of such a soil Sir John Sinclair thinks too great to be occupied by any one individual, who cannot bestow upon it constant inspection. The rotation generally adopted is wheat and green crops alternately, unless where land is first brought into cultivation, in which case oats are raised. And it has been found that wheat does not succeed well after clover ley, where the clover has been twice cut, unless the ley gets a top-dressing of manure or ashes, and unless the wheat is sown before the middle of October. It is given as the opinion of Mr. Brown of Markle, a very intelligent Scottish farmer, that the same dependence cannot be placed on a drilled crop for cleaning the ground, on a strong soil with a retentive subsoil, as may be placed on a summer fallow; he would rather recommend a six shift course as likely to be more productive, and as certainly

attended with much less labour and expense, in the order of, 1. fallow; 2. wheat; 3. clover; 4. oats; 5. beans, potatoes, turnips, or cole; 6. wheat or barley: or, where manure is abundant, an eight course shift might be adopted; the dung being applied to the fallow, and the green crop occupying the fifth year. The permanent pasture is represented as being the least productive part of the whole farm, but kept partly from the idea of convenience, and partly as ground on which the local militia of the neighbourhood may be exercised. And Mr. Curwen is said to be convinced that it is a great practical error to retain in pasture land adjoining the homestead, the convenience of this bearing no adequate proportion to the expense of bringing green crops from the remote parts of the farm, which cannot be calculated at less than three pounds per acre per mile; and has consequently determined to plough up some of the old ley near his farm offices, and convert some of the distant land into pasture. The stock maintained on this farm consists of 34 milch cows, 6 heifers, 100 South Down wethers, 20 Highland stots, about 100 work horses, and 30 oxen for ploughing; this great number of horses being mostly employed in some adjoining coal works: Mr. Curwen, however, calculates that it requires a pair of horses for every 25 acres, where land is as strong and as frequently tilled as upon his farm; this is, however, a very expensive mode of management and rendered necessary by the peculiar mode of cropping adopted by Mr. Curwen. The horses and cattle are all soiled, or fed with cut clover during the summer months, and in the winter with green food, and a portion of chaff steamed, and each beast gets a small portion of hay or oil-cake. The implements used are Small's ploughs, Macdougal's drills, Gregg's scuffers, single horse carts, and a very powerful wind thrashing mill, besides a variety of common articles. The fields intended for green crops are ploughed from ten to fourteen inches deep before Christmas, if possible, and water-furrowed and laid perfectly dry, and the crops are drilled in the spring, and twice hoed. The expenses are found to be about six pounds per acre; but a portion of this, perhaps a sixth part of this sum is expended on objects unconnected with the cultivation of the farm, as, for instance, the working of the colliery. The quantity of manure annually made is estimated at 5240 tons, and of this quantity about one-fourth part is procured as ashes from the town of Workington. The urine made by the cattle is carefully conveyed into covered reservoirs, and is pumped upon the dung-hills three or four times in a week, by which means the dung is fit to be carried to the field in six weeks. The dairy is considered an important branch in the

management of this farm, and an account is given of the quantity of milk produced, and of the expense of feeding the cows, from which it appears that the profit of a cow is above twelve pounds a year, exclusive of the calf. The farm horses are fed on cut clover in the summer, and steamed potatoes in the winter, and each horse is also allowed 10 pounds of oats, per day, when hard worked. The crops of clover are represented as most abundant, which is attributed to the system of deep ploughing, and the green crops keeping the land clean; the crops of turnips are also great, but the cultivation of potatoes on so strong a soil is attended with considerable difficulty. For arable crops the ridges are from nine to twelve feet wide, and well raised so as to throw off the rain; and this breadth is considered favourable to the drilling of the crop. Waste lands are brought into cultivation by paring, burning, and liming, at an expense of about five pounds per acre; upon these the first crop is commonly wheat, next turnips, where the situation will admit of drawing them off, and then oats, using manure to both these crops; and fallowing is recommended for wheat after the turnips, to be succeeded by clover. The produce of the whole farm is stated to be very great, and the foundation of this immense produce *deep ploughing* to lay the land dry, *abundant manuring*, and *putting in the dung deep*. Mr. Curwen, however, is said to be about to return to the practice of fallowing once in six years.

Observations.—This description of a farm so judiciously managed as that of Mr. Curwen, at Workington, must be very interesting to the practical agriculturist. It must, however, be recollected that many of the modes adopted by this opulent Gentleman are not within the means of every farmer; and the inclination to follow the system may sometimes exist where the ability is wanting; yet, in the principal points, it is within the reach of all: deep ploughing and clean weeding may be practised by every farmer in every situation, and if these be followed up with the most abundant manuring which circumstances will admit, he may hope to approach towards, though he may not equal the productive crops obtained by Mr. Curwen.

On the advantages of Oxen Ploughs. By Mr. FINDLATER. *—Farmers Mag. No 53.*

THE account contained in this paper is a statement of the comparative expenses of a pair of oxen, and a pair of horses, communicated to the writer by Sir Thomas Carmichael, Bart. of Stirling, as the result of a considerable length of experience of their respective labours; the period was five years. The *horses* were allowed oats at the rate of three firlots per week for eight months in the year, which at 24*s*. per boll is £28 16*s*.. The *oxen* were allowed oats at one firlot per week for five months only, which at 24*s*. per boll is £6; and two acres of turnips of the value of £4. per acre, which amounts to £8: leaving the difference in the keep of a pair of oxen of £14. 16*s*. The difference in the annual increase of value is estimated at £11. 15*s*. and the saving in expenses of farriery at 20*s*. annually; making a total in favour of the oxen of £27. 11*s*.

Observations.—It is clear that oxen possess an advantage over horses in the expense of their maintainence, and their improvement as cattle; and beyond this Mr. Findlater's observations do not extend; for he takes no account of the difference of work, which may be performed by the one and the other. And after all horses can never be superseded by oxen in general application as beasts of labour, since the latter are incapable of performing many things, for which horses are peculiarly adapted.

On *Crows or Rooks. By* Mr. HEADRICK.

Doubts as to the injury sustained by Crows. By a FARMER.

A Plan for the extirpation of Crows, recommended by a Member of the Agricultural Society of Castle Douglas.—Farmers Mag. No. 53.

MR. HEADRICK observes, that there are two opinions respecting these birds, which have long had a considerable influence on the rural economy of the country; for while the great body of farmers reprobate them as highly destructive, and never scruple to kill them at every opportunity, there are a few proprietors who afford them the most strenuous protection, insisting that all the injury they do to the crops is much more than compensated, by the destruction of the slugs and other vermin, which they pick up from the fields, and which, if

not thus destroyed, would soon become much more injurious to the crops than the crows themselves. The writer admits that he had been much influenced by arguments of this kind, but since he has begun to cultivate a small piece of his glebe, he has been made a complete convert to the opinion of the practical Farmer. That the good effected by these birds by picking up vermin from the fields, is at most trifling and extremely problematical, while the mischief they occasion is extensive and certain, and he now carries his hostility so far, as to contend for their utter extirpation. As an instance of the damage they occasion he states, that in a field of potatoes they destroyed not less than four bolls to the acre, by tearing out the sets in spring; and he considers their depredations on other crops as equal in value, though not so great in quantity.

The Farmer, who furnished the second of these papers, states the instance of benefit arising from rooks, on which his doubts are founded; six years since his clovers were attacked by caterpillars, which threatened their entire destruction, and if the friendly rooks had not come to his aid and extirpated the enemy, his crop of clover would have been annihilated.

The Castle-Douglas Agriculturist, enters into a very long dissertation on the natural habits of the crow, and concludes by recommending the total extirpation of the race. He expresses his conviction that the depredations committed by crows, on almost every species of crop, are of such immense extent, as to call imperiously for the united exertions of proprietors and farmers, to put a stop to the growing evil. Considering their prodigious numbers, their extraordinary cunning and sagacity, the great age to which they live, and the persevering zeal they display to rear an offspring; he admits the task of their destruction to be an herculean, and almost an hopeless labour. For crows are more numerous than any other species of large birds, and perhaps than any species of birds whatsoever, and that they live to an immense age seems to be generally admitted, though different periods, up to one hundred years, have been assigned as the probable duration of their life; to their long life and social habits, is ascribed also that cunning and sagacity which they possess, in a degree unequalled, by any other species of bird; and their strong desire of progeny, the assiduity to provide for, and courage to protect their young, which they have in common with all other animals, are noticed in order to be turned to their destruction. It is suggested as the best and the only effectual remedy for the evil complained of, for farmers and proprietors to unite their exertions to extirpate the whole race of plunderers; and though this might appear a hopeless expedient to a few individuals, or even to the inhabi-

tants of a district, yet the writer contends that its accomplishment might be expected with confidence, if the remedy should be co-extensive with the evil; if Agricultural Societies would take up the business, and heartily combine their efforts with those of landlords and occupiers. For difficult as it is to destroy any of the old crows at other seasons of the year, yet at the time when they bring forth their young it may easily be accomplished; the sportsman may then enter the rookery as often as he pleases without giving alarm, and may kill hundreds in a few days; but as it is chiefly by pulling down the nests and destroying the young that their numbers would be diminished, it is asserted that a few *school-boys* in large rookeries would destroy them by thousands. The writer thinks that if this plan was adopted a district might be cleared of crows in a few years, and that if the practice was general, or enforced by legislative provision, the whole race would soon be extirpated.

Observations.—The efficacy of the proposed remedy for the destruction of crows is less problematical than the expediency of adopting it, to which we cannot subscribe our assent merely on the declamatory matter offered in these papers.

An account of a simple Steaming Apparatus, for cooking roots, or other food for live stock.—Farmers' Mag. No. 53.

THE chief advantage proposed to be derived from the use of this apparatus, consists in saving the labour and time of lifting off and on the several vessels, and the expence of cost and repairs of leaden pipes, cocks, &c. The boiler may be of any form, and of a size proportioned to that of the box, with a furnace of a construction to afford the greatest quantity of heat to the boiler, with the smallest waste of fuel. The box may be made of stout deal plank, well jointed together; and one of eight feet long, five feet wide, and three feet deep, will serve for cooking potatoes in the space of one hour, sufficient for a days food for fifty milch cows. The box should stand within a few feet of the boiler, with its side parellel to it, and must have a second bottom with holes or grating, placed about a foot above the real bottom; and from the upper part of the boiler a pipe of wood or any other material proceeds and enters into the box, between the solid and the false bottom, conducting the steam into the space between them, which passing through the holes in the false bottom, rises upwards and mixes with the contents of the box, while the condensed steam and

water which may issue from the vegetables, drips through the apertures, and lodges on the solid bottom below. On the top of the box is a door about two feet square fitted on hinges, through which the materials to be steamed are put into the box, and this lid is kept down by its own weight alone, and consequently acts as a safety-valve to the box and boiler also, from the connexion between them; though the boiler may have a separate safety-valve, if it should be deemed requisite. And in order to prevent the accidents which arise from carelessness and negligence to a cast-iron boiler, the bottom is cut out, and replaced by malleable iron, which is not liable to similar accidents: and it is allowed that it would be a valuable improvement, if the boiler was gradually supplied with water from a cistern, in the manner it is furnished to the boilers of steam engines.

Observation.—This simple and cheap apparatus will be found effectual for all the purposes to which one ten times more expensive could be applied, and we can safely, and do, indeed, strenuously recommend it to the adoption of our readers.

On different Modes of converting Moss into Manure. By J. MOSSMAN.—*Farmers' Mag. No.* 53.

THE importance of moss as a manure having been generally acknowledged, the writer gives an account of the different methods which have been practised for facilitating the process. He states, that Dr. Rennie, of Kilsyth, recommends watering the collected heap of moss once a day, for ten days, very copiously, and when that is done to turn it up to a compact body, allow it to dry and to receive a gentle degree of heat; the Doctor is also said to be of opinion that moss may be converted into manure by passing steam through it, and more expeditiously still by exposing to a running stream of water. Lord Meadowbank's method of accomplishing easily a sufficient degree of fermentation, is by a mixture of fresh long dung with the moss, after it has been long enough out of the pit to become somewhat dry: and he proposes an equal number of alternate layings of dung and moss to be heaped together, and turning and watering when the heat increases too much. These rules the writer conceives to be so essential, that he is persuaded the Meadowbank manure (as it is called) has often failed for want of due attention to them. In his own practice he has experienced no disappointment, because he never allowed the mixture to heat too much, but adhered in the most careful man-

ner to these directions. He has, also, been equally satisfied with several trials of Rennie's method in a variety of instances; and in one respect he considers it preferable to the former, inasmuch as no hazard is run of the moss being spoiled by overheating. And by those who are apprehensive of the pure moss being too little fermented, he recommends a junction of the two methods, by preparing the moss first according to the directions of Dr. Rennie, and then mixing it with one fourth part of manure, or one third part in a more advanced state of decomposition; but as to the exact proportion of the compound experience must direct.

Observations.—There is both much good sense and practical utility in the recommendation with which this paper concludes, since too great fermentation entirely destroys the valuable qualities of moss as a manure, and without a certain degree its effects would be entirely inoperative.

Remarks on Fallowing; by Dr. WORTHINGTON.—*Agric. Mag.*

On the Impropriety of the Term Rest, as applied to Fallow; by a DENGY HUNDRED FARMER.—*Agric. Mag. N. S. No. 4.*

THE Gentleman, who communicated the former of these papers, has published two Pamphlets on the subject, and he seems a little angry at having some of his positions doubted in the Agricultural Magazine.

The Essex Farmer, who resides in Dengy Hundred, replies to his opponents, but without any new argument: he allows the system of dismissing fallows to be very fine in Theory, but again insists that they cannot be dispensed with in practice upon poor and tenacious clay soils.

Observations.—We have merely noticed these papers, as a part of those which relate to the following controversy in the Agricultural Magazine; they are in themselves uninteresting.

RETROSPECT

OF

PHILOSOPHICAL, MECHANICAL,

CHEMICAL AND AGRICULTURAL

DISCOVERIES.

No. XXXV.] *May, June, July, August.* [1813.

AGRICULTURE.

A Series of Experiments in Agriculture, feeding Live Stock, and Rural Economy. By Mr. JOHN WRIGHT.—*Agric. Mag. N. S. No.* 2, 3, 4, 5, 6.

These Experiments were communicated for publication, at the request of the Proprietor of the Magazine, and are stated to have been conducted with all the care and attention which the several subjects demanded.

EXPERIMENT 1. *On the utility of shearing lambs the first year.*—This was made in 1804, when twenty ewe lambs, as equal as possible, were selected from the flock, and ten of them shorn in June, and the other ten not; they were all shorn the following year, and wool of the lambs twice shorn, produced sixteen shillings more than the wool of those which had been shorn only in the latter year: the keep was the same of both.

EXPERIMENT 2. *On shearing lambs.*—Some persons having suggested to Mr. Wright that June was too early in the year for shearing lambs, he repeated the experiment, varying it only by shearing in August, upon other twenty lambs, selected as before, and the clear profit of those twice shorn, was in this instance twelve shillings.

On these experiments he remarks, that not only is a greater weight of wool obtained by shearing twice than once, but the

wool of the first clip is also more valuable: the average of the two experiments points out the profit of the method: he was so well convinced of the propriety of shearing lambs the first year, that he continued the practice as long as he kept the Leicester breed of sheep, steering however a middle course as to the times, and shearing his lambs in July.

EXPERIMENT 3. *What is the most profitable crop for a farmer to grow after turnips eaten off by sheep?*—In order to ascertain this two roods were measured off, and one planted with potatoes in drills, two feet asunder: and the other sown with one bushel of barley, broad-cast; the potatoes produced eighty bushels, and were sold for six pounds; the barley was only six bushels, worth five shillings per bushel; but the extra expenses attending the potatoes were ten shillings, giving to them a superiority of four pounds per rood, or sixteen pounds per acre.

EXPERIMENT 4. *Whether wheat will produce the best crop after beans, white peas, or potatoes, on a poor gravelly soil.*—Three separate roods, on each of which had grown respectively the crops mentioned, and they were all sown at the same time, with three pecks of wheat each, without any manure: the produce of the wheat after potatoes, was at the rate of fourteen bushels, one peck, four quarts per acre; the produce after beans was at the rate of fourteen bushels; and the produce after white peas, at the rate of thirteen bushels, one peck per acre; from this it is inferred, that potatoes are not an exhausting crop.

EXPERIMENT 5. *Whether drilling barley after turnips, or sowing it broad-cast, be most beneficial.*—Three separate roods of turnip land was taken for this experiment: one was sown broad-cast with a bushel of barley; one drilled at nine inches asunder with two pecks; and the other drilled at eighteen inches with a peck and a half: the last produced a crop after the rate of thirty bushels per acre; that drilled at nine inches distance, produced after the rate of twenty-eight bushels per acre, and the broad-cast produced after the rate of twenty-four bushels per acre; and hence is inferred the superiority of drilling at eighteen-inch distances.

EXPERIMENT 6. *Whether hogs will pay for barley to feed upon when very cheap.*—Barley being at twenty shillings per quarter at the latter end of the year 1803, six hogs were bought at thirty shillings each, and kept constantly on barley and water, and were sold again when they had eaten ten quarters, for £.21 18 0, which left £.12 18 0 for the barley, or 25s. 9½d. per quarter.

EXPERIMENT 7. *Between sainfoine, burnet, lucerne, chicery, and timothy grass.*—The soil was a good loam, well prepared

in drills one foot asunder, and the quantity of ground was exactly equal: the produce was cut the first time in July; the sainfoine weighed 75lbs.; the burnet 164lbs.; the lucerne 62lbs.; the chicery 1275 lbs.; the timothy grass did not grow: the result then was, that the chicery was above twenty times as productive as the lucerne, but the lucerne did not arrive at its perfection the first year, while the chicery grew no more after the first cutting; the burnet continued green the whole winter, but no stock would eat it till compelled by extreme hunger. Mr. Wright considers both sainfoine and lucerne very valuable plants after the first year, but it is necessary to keep the latter very clean from weeds to render it productive.

Experiment 8. *Between lucerne, burnet, and sainfoine, upon a poor gravelly soil, in drills two feet asunder.*—Three perches of ground were sown with each kind of seed, and the produce of the whole was so trivial the first summer, that it was not weighed: in the second year each was cut three times, and the weight of the lucerne per acre was 7 tons 5 cwt.; of the burnet per acre 11 tons. 2 cwt.; and of the sainfoine per acre 14 tons. 16½ cwt.; the sainfoine therefore greatly surpassed the others, and the writer accounts for it in this manner: he does not think lucerne arrives at its full perfection the second summer, or that the gravelly soil was sufficiently good for it, as it requires a deep dry soil, while gravel is of all other soils, the best adaped for sainfoine.

Experiment 9. *On feeding sheep in stalls on various kinds of food.*—Some shearling wethers, worth 30s. each, after being accurately weighed alive before eating their food, were put up in stalls; two were fed upon four bushels of white peas, at 5s. per bushel, which were boiled, and three gallons taken out to defray the expense of boiling; two other sheep were fed upon four bushels of the same peas, as they came from the flail; these finished their food in nine weeks, and gained 31lbs. of mutton; the former finished their food in ten weeks, and gained 33lbs. of mutton; the preference therefore is given to boiling the peas: and the experiment is held to prove, that when the peas are not worth more than 40s. per quarter, and mutton is worth 8d. per lb. that they may be beneficially given to sheep.

Experiment 10. *Between two sheep fed upon fourteen pecks and a half of boiled white peas, and two upon three bushels of barley, boiled, at 3s. per bushel, and 2s. allowed for boiling.*—The result was, that the two sheep fed upon the peas, gained 33lbs. of mutton, and the sheep fed on boiled barley gained 35lbs.; and the sheep were five weeks longer in eating the amount of 20s. in boiled barley, than in eating the same amount in peas.

EXPERIMENT 11. *Between two sheep fed upon dry barley, and two sheep upon boiled barley.*—The sheep upon the boiled barley gained 35lbs.: the sheep upon the dry barley were allowed 2½ pecks extra to balance the expense of boiling, and it was estimated that they would have gained 38lbs. but one of them was taken ill, and obliged to be killed during the experiment. Here it is remarked, that dry barley might seem the most profitable, since it appeared to produce the greatest weight of mutton; bnt the contrary was the fact, for one of the sheep was obliged to be killed, from the dry barley swelling the stomach in a manner to be attended with dangerous consequences: and of twenty-seven more sheep feeding upon dry barley in the field at the same time, one absolutely burst, three more were obliged to be killed, and several of the rest were ill, and long before they recovered.

EXPERIMENT 12. *Between pigs and sheep upon barley.*—The barley was boiled for the sheep, but the pigs had theirs as it came from the flail, but constantly covered with water, and 2⅛ pecks more in quantity, to balance the expense of boiling; the weight of mutton gained was 35lbs. which at 8d. per lb. gave 31s. 6d. per quarter for the barley; the pork gained was 67lbs. which at 6s.-per stone, was at the rate of 34s. 5d. per quarter for the barley; the pigs were continued feeding, but at the next weighing had gained only 44lbs. which was at the rate only of 23s. per quarter for the barley; from whence it appears, that the pigs gain the most upon barley at first putting up.

EXPERIMENT 13. *Between pigs and sheep upon boiled barley.*—Three pigs were valued at 5l. previous to putting up to feed upon boiled barley; they eat 44 bushels, and were then sold for £.12 16s.; which, allowing 16s. for the trouble of boiling, paid 25s. 5¼d. per quarter for the barley; the sheep paid 31s. 1d. per quarter.

EXPERIMENT 14. *Between hogs and sheep upon dry barley.*—The pigs paid 27s. 2d. per quarter for the barley, the sheep only 17s. but one of the sheep went on the best, and fed the fastest of any Mr. Wright ever had, but the other was so frequently ill from eating the barley, as to be quite pined before it would touch it again; and if therefore it be considered, that the profit on the sheep was gained by one only, they would then pay better for it than the pigs.

EXPERIMENT 15. *Between pigs upon ground and whole barley.*—Four pigs were put upon broken barley, and in 35 days gained nine stone four pounds; four other pigs were put upon whole barley, and in 39 days gained eight stone six pounds; the quantity of barley consumed by each set was 13 bushels and

a peck; hence the superiority of feeding on ground barley was incontrovertible.

EXPERIMENT 16. *On stall-feeding rams.*—Two three-shear rams were put up to feed; one was allowed 10 lbs. of oil cake, and when he had finished that a bushel of white peas, making the expence of his food in the whole twenty shillings; he gained in weight 48 lbs. which cost at the rate of eight-pense per lb. the other was allowed three bushels of dry barley, and four bushels of potatoes of the value of fifteen shillings; he lost in weight, which was attributed to dry barley disagreeing with him, and making him ill. After all, says Mr. Wright, it is still a question, whether ram-mutton be worth eight-pense per pound.

EXPERIMENT 17. *A comparative trial whether sheep or milking cows will pay best for consuming boiled barley.*—The result of the comparison was, that the sheep paid thirty-one shillings one penny per quarter for the barley they consumed; two milking cows were regularly fed upon the same food, each having half a peck morning and evening; they appeared remarkably fond of it, and eat it with great avidity, but produced no additional quantity of milk; and it could not be ascertained, whether they had or not gained any thing in weight of beef.

EXPERIMENT 18. *On picking the blossoms of the potatoes.*—For this experiment two half roods were fixed on; on one the blossoms were picked clean off, on the other they were left; the produce on the former part was 39 bushels and a half, and the produce where the blossoms were left, was forty bushels and a half.

EXPERIMENT 19. *On the best method of sowing white peas.*—One rood of a poor gravelly soil was divided into four equal parts; on the first part the peas were sown in clusters or circles, and supported by sticks, the rows three feet asunder, and the clusters two feet distant in the rows; on the second part they were drilled at three feet asunder, and left to trail on the ground as they pleased; on the third they were drilled as in the preceding part, and supported by sticks as garden peas; and on the fourth they were also drilled at three feet, and each two rows throughout the piece turned together for the mutual support of each other: the clusters produced after the rate of sixteen bushels per acre; those unsupported by sticks twenty-one bushels; those supported as garden peas thirty-two bushels; and those turned two rows together twenty-six bushels. This experiment is given to prove that sowing in clusters, notwithstanding the expense, produces less than simply drilling them by five bushels per acre; and though there was an extra produce of six bushels per acre, where they were supported by sticks; this was not deemed sufficient to pay the expense of sticking them.

EXPERIMENT 20. *On the best time for sowing Horse Beans.*—One ounce of beans was planted the First of December; one ounce the first of January; one ounce the 16th of February; one ounce the 21st of March; and one ounce the 4th of April: the produce of the seed sown in December was the greatest; that sown in February, next; that sown in January held the third place; that sown in March, the fourth; and that sown in April produced the smallest crop. From this experiment is inferred, the importance and necessity of early sowing; for though but few stems of the December-sown crop survived the winter, yet they made ample amends in corn; while on the contrary, the March and April crops were very luxuriant, but deficient in grain. February, however, on the whole, is considered the safest month to sow beans.

EXPERIMENT 21. *On the best time for sowing of oats.*—An ounce of oats was sown on each of the same days as the beans in the preceding experiment; they were planted in rows one foot asunder: the result was, that the February-sown Oats were the most productive, then those sown in April, then those sown in March, then those sown in January, and the smallest produce was those sown in December.

EXPERIMENT 22. *On the best time for sowing barley.*—The same days were taken for sowing on each an ounce of Barley; that sown in April was the best, in March the next best, in December the next, that sown in January held the fourth, and the February sowing was the worst; and it is considered plain, from this experiment, that April is by far the most advantageous month for sowing barley.

EXPERIMENT 23. *Comparative trial between one acre of beans, and one of potatoes.*—Two separate acres were measured off in a gravelly soil, and manured equally, and one planted with thirty bushels of potatoes in drills, and the other sowed broad-cast, with five bushels of beans; the loss on the bean crop was two pounds nine shillings, but they were sold at only four shillings per bushel; the profit on the potatoe crop was one pound, three shillings, and six-pense; giving a superiority in growing potatoes over beans, of three pounds, twelve shillings, and six-pense per acre.

EXPERIMENT 24. *On the proper depth seed wheat ought to be laid.*—In order to ascertain this, Mr. Wright took 480 sound healthy corns of wheat, and planted them in twelve rows, one foot asunder, and two inches distant in the rows; the first row was planted half an inch, and the succeeding rows respectively each half an inch deeper than the preceding one, so that the twelfth row was planted at the depth of six inches; forty corns

were planted in each row: of the half-inch deep there vegetated thirty-eight corns; of the inch deep thirty-nine corns; of the inch and half deep thirty-sevens corns; of the two inch deep thirty-six corns; of the two inch and half deep all the forty corns; of the three inch deep thirty-two corns; of the three inch and half deep twenty-eight corns; of the four inch deep twenty-nine corns; of the four inch and half deep twenty-eight corns; of the five inch deep twenty-seven corns; of the five inch and half deep twenty corns; and of the six inch deep eleven corns: the first eight rows continued green and vigorous throughout the winter, and produced an excellent crop, but the four looked yellow in colour, and were very weak and sickly, particularly that planted six inches deep; and from this experiment it is assumed, that not only a prodigious number of the grains of wheat are buried when ploughed in deep, but also that those which do vegetate are always weak plants; and though on the soil on which this experiment was made, two inches and a half was found the preferable depth, yet it is imagined, that on lighter soils, three inches might not be more than sufficient to secure the seed from the frost; and since by plowing in wheat, it gets laid all depths, and by harrowing, it is too often slightly covered; it is hinted, that both these inconveniences may be obviated by using the drill, which would deposit the seed at any given depth required.

Experiment 25. *On the importance of weeding by hand broad-cast crops.*—The mischiefs arising from weeds are forcibly brought to the notice of the readers, by remarking that in the first place the present crop is materially injured by them; secondly, that the weeds come to perfection as early as the corn, and shed their seeds on the land to the injury of future crops; thirdly, that what do not shed are brought home and mixed with the dunghill, and so carried back to the land with the manure; fourthly, that the corn full of weed-seeds will not fetch so much at market by three or four shillings a quarter; fifthly, that corn full of weeds cannot in harvest be carried so early by some days as that which is free from them; and sixthly, that weeding will encourage manual labour, which ought to be done as extensively as possible: and from these premises is argued the importance and the advantage of weeding corn crops: as the proof of the advantage attending it Mr. Wright states, that out of seven acres of wheat on a fallow he left one acre unweeded, and that the produce was less by four bushels and a-half than that of the average of the six acres, which were carefully cleaned from weeds.

Experiment 26. *On weeding broad-cast wheat.*—The preceeding experiment was repeated on broad-cast wheat; and an

acre of unweeded wheat produced but 16½ bushels, while three acres of the same crop, which were cleaned from weeds, averaged 19 bushels per acre.

EXPERIMENT 27. On weeding broad-cast wheat.—A similar experiment was tried upon wheat sown on black clay land; the crop was very much infested with weed called *pairiff:* the weeded part averaged 26 bushels per acre, while the unweeded part produced only 25 bushels, and a fourth part of this noxious seed-weeds.

EXPERIMENT 28. *On the utility of weeding broad-cast barley.*—A field of barley, containing six acres, was got into fine tilth and well manured, but soon after the corn came up. there was found to be more chalock than corn; one acre was then measured off to be left to its fate, and the other five were carefully weeded; the acre unweeded produced but 13 bushels, whilst that which was weeded produced 28 bushels; giving the vast acreable superiority of 15 bushels to the weeded part, a clear profit by weeding of not less than three guineas per acre. And it is remarked that many farmers, who do weed, defer the coperation too long, and stay till the weeds have checked the corn, perfected their own growth, and ceased to rob the soil of nourishment; and if it be granted that weeds ought to be eradicated at all, it necessarily follows that they ought to be eradicated in their infancy.

EXPERIMENT 29. *Comparison between five sorts of oats.*—In February, 1803, five different sorts of Oats were planted on equal quantities of ground of the same quality: 60 grains of the potatoe oat produced 114 stems; 60 grains of the Poland oat 140 stems; 60 grains of the English oat 104 stems; 60 grains of the black oat 117 stems; and 60 grains of the skreenings of the black oat produced 160 stems.

EXPERIMENT 30. *Comparison between thick and thin sowing wheat, both broad-cast.*—In October, 1806, two equal portions of land were measured off; and one of them sown with wheat, broad-cast, at the rate of one bushel and a half to the acre; and the other sown with the same wheat, broad-cast, at the rate of four bushels to the acre. At harvest the nicest observer, could not distinguish which was sown the thickest or best, though the thick sowed, looked infinitely best all winter. The experiment was not carried so far as to ascertain the products separately.

EXPERIMENT 31. *On the mildew in wheat, and the proper time for cutting it.*—Amidst the differences of opinion which prevail among farmers, respecting the proper time of cutting mildewed wheat, this winter, having the misfortune to have 60 acres of wheat in that situation, endeavoured to ascertain the fact

by experiment; he reaped one part on 9th of August, and this weighed 55lbs. per bushel; he reaped another part on the 13th of the same month, which weighed 54lbs. per bushel; another on the 15th which weighed 55lbs. per bushel; another part on the 17th which weighed 54lbs. per bushel; another on the 21st which weighed 54½lbs. per bushel; and the remaining part on the 28th which weighed 56lbs. per bushel; from which results, he considers an opinion he had previously formed to be well founded, that the longer mildewed wheat is suffered to stand the heavier it weighs; he thinks also, there are other advantages derived from not cutting it early, since, if this be done, it is almost impossible to thresh it clean with the flail; and the letting this crop wait, allows time for attending to others, which are more susceptible of receiving injury from standing.

EXPERIMENT 32. *Comparison between two sorts of horse beans.*—The kinds of beans used for this trial, were the large ticks, and the small purple beans, called Hottentots, from the Cape of Good Hope, and spoken of as prolific bearers: one hundred of the Hottentot beans produced 2522, being rather more than *twenty-five* for one; but one hundred tick beans, produced 3076, being more than *thirty* for one; this trial was made on a good soil, adapted to the growth of the ticks, and the inferiority of the Hottentots, would not have been so great on a poorer soil.

EXPERIMENT 33. *Comparative trial between the shoots of potatoes, and the cuttings for sets in planting.*—Two equal beds were prepared in a garden, and one planted with half a peck of potatoes, weighing 7lbs. cut into sets, the other was dibbled with the same number of shoots, about four inches long, with the tops just above ground: the produce from the cuttings, weighed 64lbs. the produce from the shoots, 66½lbs.; the success of this experiment is attributed to the fine tilth and good state, for if they had been in a foul cloudy stiff soil, the cutting would certainly have been most productive.

EXPERIMENT 34. *One acre of land potatoes and corn alternately for six years.*—A particular account of the expense and produce of each respective year: the first year, was a wheat crop, giving a profit of £.1 11s.; the second, a potatoe crop, giving a profit of £.5 7s.; the third year, was a barley crop, by which a loss was sustained of 6s.; the fourth year, a potatoe crop, gave a profit of 19s. 6d.; the fifth year, a crop of oats, gave a profit of 17s. 6d.; and the sixth year, a third crop of potatoes gave a profit of £.4 0s. 8d.; it is however remarked, that this profit though considerable, yet arose chiefly from the potatoes, and that this system is not a desirable one to follow, where the principal object in view is a profit on the corn crops.

EXPERIMENT 35. *On stall-feeding Oxen upon Potatoes.*—Two small oxen, of £24 value, were put into stalls to be fed entirely upon potatoes; but there soon was a necessity for changing their food, for the potatoes scoured them very much; they had therefore some hay each twice a day, and on this food they throve well, but not fast; and after they had consumed 22 cwt. of hay, of the value of £3 6 0, and 157 bushels of potatoes, they were sold for £35; which allows about one shilling per bushel for the potatoes consumed by them.

EXPERIMENT 36. *On the power of different Manures.*—The experiment was made by applying nine different kinds of manure to patches of barley of 60 grains each: hen-dung was found to be most efficacious; duck-dung second; sheep-dung third; coal-ashes and hog-dung exactly alike; horse-dung sixth; wood-ashes seventh; goose-dung not much above the average of three patches sown without manure; and cow-dung was evidently prejudicial.

EXPERIMENT 37. *On the powers of Manures. (Made at the request of the Board of Agriculture).*—Four kinds of manure were used, and half a rood of ground was allotted to each: the first part was manured with three tons of fresh stable dung in a straw state; the second part was manured with two tons of rotten stable dung, eight months old; the third part was manured with fifteen hundred weight of dry barley-straw burnt on the ground; and the fourth part was left unmanured. The ground received from ploughings, and the parts were all sown with turnips the same day, and escaped the fly, and were hoed in due time. The produce of turnips on the first part weighed 18 cwt. 6 stone, 6lbs.; on the second part 16 cwt. 1 stone, 4lbs.; on the third part 8 cwt. 3 stone, 7lbs; and on the fourth part 1 stone, 8 lbs. The turnips were eaten on the ground separately by sheep, and the four half roods were all ploughed and sowed separately with two pecks of barley each. The produce of barley after the fresh stable manure was at the rate of 30 bushels 2 pecks per acre; after the rotten manure, 36 bushels 3 pecks per acre; after the burnt straw 30 bushels 1 peck per acre, and where there was no manure 14 bushels 3 pecks per acre. From this experiment is inculcated the great importance of manuring for this crop. The next crop was clover,—to be succeeded by oats: the clover was sown among the barley, 274 lbs. to each half rood. The produce of mowing after the stable manure was at the rate of 20 cwt. per acre; after the rotten manure at the rate of 21 cwt. per acre; after the burnt straw at the rate of 18 cwt. per acre; and where it was without manure at the rate of 8 cwt. per acre: the value of the feed, before and after mowing, about paid the expense of

getting the crop, and where the rotten dung was laid there was a small superiority. The clover ley was ploughed for oats, and 2½ bushels were sown on each of the four parcels. The rate of produce after the stable dung was 38 bushels per acre; after the rotten dung 40 bushels per acre; after the burnt straw 38 bushels per acre; and without manure 32 bushels per acre. The half rood, without manure, producing a crop so nearly equal to the manured parts, was considered a proof that the power of the manures was nearly exhausted; and though in the comparison of manures *rotten* dung appeared superior, yet it still leaves the question undecided, where three tons of fresh stable dung are sufficient to make two tons of rotten dung.

EXPERIMENT 38. *On the proper depth Seed Barley should be deposited.*—Four different depths were taken; the first merely harrowing in, the second ploughing in, the third ploughed in two inches deep, and the fourth ploughed in four inches deep. The crops were all excellent and no superiority distinguishable to the eye, but when the crop was thrashed the experiment was quite conclusive in favour of shallow sowing, as the quantity decreased every time the seed was laid deeper.

Observations.—At the end of this experiment it is intimated that the publication will be further continued, but five months have elapsed and nothing more has appeared. Whether we here take leave of Mr. Wright's Experiments, or whether we shall have more of them to notice, we can truly say, that they appear to have been directed with a view of promoting useful and practical agricultural knowledge.

On Irrigation, according to the rule, practised by the Fiorin School; in a Letter to Mr. MACCULLOUGH, *of Ardwall;—by* Dr. RICHARDSON.—*Agri. Mag. N. S. No.* 5.

On the modern practice of Irrigation, as generally now followed, in a Letter to WILLIAM MUIR, *Esq. by the same.—ibid. No.* 6.

The circumstance which gave rise to the measure of contrasting the two schools of irrigation, and of comparing their respective merits on the same spot, was the visit made by the committee of the Kirkcudbright Agricultural Society to Dr. Richardson, at Clonfeckle, to view the Fiorin grass under his own cultivation; of which an account is given in the preceding part of this volume. (see page 88, &c.) Irrigation being the favourite object in Scotland, of the two gentlemen to whom these letters are addressed, it was proposed by Dr. Richardson, when he became a member of

the Scotch Society, of the stewarty of Kirkcudbright, to try its effects upon his favourite Fiorin. A meadow was chosen for the experiment, which was divided into three portions; the first cloathed with natural grass, to be mown at the usual period; the second to be laid down for irrigation in all the regular forms of the modern school, without in the least deviating in the practice, or the periods of moving from those in use among the most approved irrigators; the third to be assigned to Fiorin under irrigation: of this latter portion, some parts to be irrigated in November, and others in February, and to be continued through the summer, the water to be *one week or less* on the meadow, and *two* weeks off it; but not to be mown till October. This is the process of irrigation according to the rules of the Fiorin School. On the modern practice of irrigation, nothing is found in these letters, but a few declamatory observations.

Observations.—We have experienced considerable disappointment in the perusal of these letters, which are neither worthy of the writer, nor of the gentlemen to whom they are addressed; and we think Dr. Richardson would have acted more wisely and more consistently, if he had deferred their publication, till he could have communicated the results of the experiment alluded to.

On Plantations of Forest Trees, at Keffeeton, in Dorsetshire. By Dr. BAIN.—*Trans. Soc. Arts. Vol.* 29.

This gentleman, having obtained the approbation of the Society for his exertions in planting, determined to make farther exertions in the same line of improvement, by covering such parts of his estate, as was not adapted to the purpose of husbandry, with trees suited to the nature of the soil. On an extent of heath land, exceeding 125 statute acres, which had been exceedingly well fenced from the depredations of sheep and cattle, and where holes, at $4\frac{1}{2}$ by 5 feet asunder had been previously made, he planted in the autumn of 1807, and spring of 1808, Scotch firs, 249,700; pinasters, 5,410; larches, 2,150: and spruce furs, 1,259; the greater part of which had been raised from seed in his own nursery, where they had been planted out. The soil of the plantation, was gravelly and poor, the situation rather elevated, and much exposed to the influence of the sea winds from the south coast; yet, notwithstanding these circumstances, the trees continued in a healthy thriving state. The few vacancies which happened, he filled up with the pinasteral one, as on such soils and exposures, it was found the best nurse for the others, for it grows most rapidly, is quite regardless of the sea winds, and is also, when ripe,

a tree of considerable value. Dr. Bain states it to have been ascertained, that in favourable situations, the wood of the larch comes to perfection at 40 years growth, that of the pinaster at 60, and that of the Scotch fir at 80 years growth; but his own experiments shew, that the pinaster in an earlier stage, increases more in circumference than the larch, though the latter may make the greater increase in height.

Observations.—The Society rewarded these exertions of Dr. Bain, with their gold medal; and it is hoped that the bleak hills of the sea coast of Dorsetshire, may be cloathed with valuable timber, from the emulation occasioned by the rewards of the society.

An account of a Pot for preserving Butter from becoming rancid in warm Weather, or in hot Climates. By Mr. HODGE, *of Bride Lane, London.—Trans. Soc. Arts. Vol.* 30.

THIS is nothing more than a common butter pot, but is covered with an earthen cover, made of that porous kind of earthenware, which will permit water to pass through it, and in the form of a dish, so that this being filled with water, the water percolates down the sides, and produces a coolness by its constant evaporation.

Observations.—This simple but useful contrivance, was rewarded by the Society of Arts, with a premium of 10 guineas.

Account of the improvement of tweny-one acres of Boggy Land, at Clapham, Yorkshire. By Major BRYAN HESLEDON.—*Trans. Soc. Arts. Vol.* 30.

THIS piece of ground presented a very serious obstacle to its improvement, inasmuch as it was surrounded on all sides by a hill, out of which the water issued, and at times completely inundated it; a main drain was however carried through it, in effecting which, great expense was incurred, it being 160 yards in length, and from 6 to 12 feet in depth. When this out-let was made through the higher ground, which was partly rock, cross drains were cut in such a manner, as to form a junction with the main drain from seven to ten yards distant from each other; and these were flagged at the bottom, and walled with stone at least eight inches from the bottom, and covered with flat stones, and afterwards filled up with earth; and many of the smaller drains

were formed in the segment of a circle, so as to communicate at each end with the main drain, and one of the feeding side drains.

Observations.—The mode of curbing the drains in such a manner, as to discharge the water at both extremities, appears to be a new method, and deserves to be generally known, as an improvement in the mode of draining lands, which are very wet and boggy.

On Plantations of Forest Trees. By Dr. AINSWORTH.—*Trans. Soc. Arts. Vol.* 30.

THE plantations of this gentleman, are at Grizedale, in Lancashire, and cover 77 acres of ground, part of a barren common, long since inclosed and surrounded by a stone wall; 16 acres were planted in 1807, with 22,700 larch, 3,700 oaks, and 2,000 Scotch firs; and the remainder in 1809, with 96,150 larch, 10,300 Scotch firs, 3,400 oaks, 1,900 beech, and 1,000 Spanish chesnuts; the whole plantation containing 151,240 forest trees.

Observations.—This extensive plantation is certainly a very praiseworthy exertion on the part of a gentleman, whose professional duties confine him almost entirely to the metropolis. We are glad to see that some of the wild Lancashire hills, are likely to become at last, both ornamental and useful.

Account of a method of feeding Milch Cows with steamed food. By J. C. CURWEN, *Esq.—Trans. Soc. Arts. Vol.* 30.

IN the prosecution of a system which he had long practised, of giving cooked food to animals, Mr. Curwen turned his attention to the cheapest mode of supplying milch cows with it; and he conceives that he has been at last completely successful. He uses a steamer of 100 gallons contents, on each side of which are fixed three boxes, containing 11 stone each of chaff, (the husks of corn,) which in steaming, gains more than two-thirds of its original weight. The steam is conveyed by various stop-cocks, into the lower part of the boxes, and in this manner one, two, or three boxes may be steamed at the same time; the quantity of fuel required, is about two lbs. for each stone of chaff. In giving the steamed chaff to the cattle, two lbs. of oil cake are mixed, with a stone of chaff, and the milch cows and oxen are fed with it morning and evening, having an allowance of one stone at each time. When taken from the steamer, the food is put into wooden

boxes, which are mounted on wheels, to be drawn to the place where used; and the chaff requires to stand some time to cool, before it is fit for use. The cost of food for each cow per day, is estimated—chaff, two stone, steaming, &c. 1d.; oil cake, four lbs. 4d.; eight stone of turnips 4d.; wheat straw 1d.; total 10d. The average of milk, on a stock of 36 milch cows, was found to be 13 wine quarts for 320 days; which gave a clear profit of nearly half the produce, estimating the manure as equal to the labour. The cows were never suffered to be turned out, but to prevent their being lame, their hoofs were properly pared, and they stood with their fore feet in clay; and their general condition was such, that they were fit for the shambles after a few weeks feeding, with very little loss from the first cost.

Observations.—The great superiority of Mr. Curwen's method of feeding milch cows with warm food, will be best seen, by comparing his with the state of a London Dairy. It needs only to be generally known, in order to be generally followed.

Account of Land gained from the Sea. By JOHN AUSTIN, *Esq. of Grange, near Strabane, Ireland.*
Trans. Soc. Arts. Vol. 30.

IN the year 1806, Mr. Austin embanked about 300 Scotch acres of a swampy marsh, on the lands of Grange, in the County Tyrone, situate on the river Foyle, over which at spring tides the whole surface was covered, and frequently by neap tides also; covering it from one to four, and sometimes five feet deep of water. By the embankments however, and drains from six to four feet in depth, the land was reclaimed, and placed in good cultivation, giving in meadow grass from three to four tons of hay per acre, and the other part producing considerable crops of oats and potatoes. The expense is allowed to have been very great, but yet much less than the improvement would have justified.

Observations.—We believe this to have been the most extensive improvement of this kind, which has yet been made in Ireland by an individual; and the reward of a gold medal from the Society of Arts, in London, will, we hope, prove a stimulus to others in Ireland, to attempt similar undertakings.

On the Culture of Summer Wheat, or Blé Tremois. By C. T. Skurray, Esq.—Trans. Soc. Arts. Vol. 30.

This communication was accompanied with a specimen of the real summer wheat (Triticum Ostivum) or Blé Tremois of the French, which Mr. Skurray had grown with great success for some years at his farm in Devonshire. As its merits had been so fully stated by Sir Joseph Banks, in his Letters on the subject to the Board of Agriculture, this paper is confined to a short account of the method of cultivating it. It is stated that for some years it had produced per acre double the quantity of the common wheat, and was in 1811 remarkably productive. The important considerations offered in its favour are; 1. It may be sown with success so late as the first of May. 2. It requires no extra culture beyond other spring corn. 3. It is a better nurse to clover than barley or oats. 4. It contains more nourishment than common wheat. 5. It yields (on soils unfit for winter wheat) a large increase. 6. The straw is excellent fodder for cattle, and superior to barley straw.

Mr. Skurray cultivates this wheat in the same manner as any other spring corn, and knows it to succeed admirably after turnips. And wherever the contrary has happened, he conceives it to arise from the difficulty of procuring genuine seeds of the true summer wheat; for although there are upwards of forty varieties of this species, some are so inferior as to give little profit to the growers. The grain is not found to be subject to any distempers, nor does the blight affect it like common wheat. Though this wheat thrives well on various soils, yet a loam inclining to stiffness is reckoned the best; but a light soil after turnips eaten off by sheep will produce a good crop; it is usually sown broad-cast from the beginning of April to the first week in May; and the common practice in Devonshire is to sow it after a green crop, and if the land is in heart it requires no manure; it ripens about the same time with common wheat, is not subject to the mildew, and as the straw is slender, is mown with the common scythe. The weight of a Winchester bushel in 1810 was 60 lbs. and in 1811 was 58 lbs. and the average produce per acre twenty-five bushels, though in one instance it was as high as thirty bushels; the price in the markets was as good as that of red lammas wheat, and it was as eagerly bought by the Millers.

In 1809, by way of experiment, part of a field was sown with summer wheat, and the remainder with barley; the land was poor and not well worked; the barley produced 17 bushels per acre, which at 4s. 9d. per bushel, amounted to £.4 0 9; the wheat yielded 21 bushels of a good sample, and sold for 14s. per

bushel, or per acre £.14 14 0, giving a superiority in favour of the summer wheat of £.10 13 3 per acre. In 1811 the experiment was repeated on better land, with a greater difference, and consequently greater profit in favour of the wheat. In the same year, in a field of eight acres, seven acres were in common wheat and the other acre in summer wheat; the winter wheat was struck with rust, so as to be scarcely worth harvesting, while the summer wheat produced thirty bushels per acre.

Observations.—The farmer can only be deprived of the benefits of cultivating summer wheat, by sowing an improper or imperfect variety of the seed; it is to accuracy in this point then, that his attention should be chiefly directed.

Account of fifty Acres of Bog redeemed by Underdraining. By Francis Haggitt, D. D.—Trans. Soc. Arts. Vol. 30.

On the prebendal estate of this reverend Gentleman, about four miles from Durham, was a morass of fifty acres, producing nothing but insulated tufts or hillocks of very coarse grass, and a few stunted sallows, and on which cattle would go only in dry summers; the annual value at most was two shillings and sixpence per acre. The meditated improvement was a long time deferred, on the supposition that a sufficient fall could not be obtained; but a trial was made in January, 1810, and the work completed in about eighteen months. The drains varied in depth from three to seven feet, and were laid in the conduit form, with side stones and a cover, and with flag stones at the bottom wherever it appeared necessary, forming an open space of seven inches by five, for the passage of the water. Where quicksands occurred, in which the stones would sink, planks were laid at the bottom for the side walls to rest upon, with shoulders to prevent the stones from slipping inwards on the boards. The soil, when dry, proved to be a rich strong loam, and the tenant consented immediately to give forty shillings per acre for the new drained ground, which has been since divided by whitethorn hedges, and most of it has been ploughed, and produced good crops of oats or turnips. The whole expense was £.847 2 4.

Observations.—This valuable improvement by a tenant for life was rewarded by the society with their gold medal; and the reflection that the whole expenditure will be replaced with interest in about fourteen years, holds out a sufficient inducement to other persons in similar circumstances, to attempt what may at first seem, an expence not to be replaced within the limits of a single life.

An improved construction of a double jointed Horse-Shoe.—Farmers Mag. No. 53.

It is remarked that the hoof of a horse has a constant tendency to increase in circumference, and that when this natural propensity is counteracted by the operation of a firm ring of iron nailed all round, the least powerful part yields to the pressure, which then falls upon the tender mechanism of the frog, excites a high degree of inflammation, and ends in contraction. To remedy this, it is proposed to use a shoe jointed about the middle of each side, having a sunk hole near the point of the heel large enough to admit the end of a screw bar. A screw bar is then to be made in two or three parts, similar to the machine in daily use for preserving the shape of hats, which is to be put into the shoe, whenever the horse is not at work, and then screwed by means of a double winch, so as to keep the heels of the shoe moderately extended; and this bar may be entirely removed when the horse is wanted for his labour, and be again replaced when he returns to the stable. And as much has been said about the mischief arising from shoes remaining too long upon the foot, the writer observes, that it matters not how long a jointed shoe remains, as the joints admit of the natural augmentation of circumference.

Observations.—We are inclined to give the preference to this, over every mode formerly suggested for preventing the contraction of the foot of the horse, an object deemed of much importance by the Professors of the Veterinary art. And it appears to us that the double jointed shoe alone, even without the bar, is a valuable discovery, inasmuch as while the shoe remains firmly fixed to the foot, it admits of all that expansion at the heel which is so essential for preserving the frog, or internal part of the foot from inflammation, which invariably ends in contraction, or closing of the clefts of the heels. One of the most prevalent, and at the same time most pernicious diseases, arises from bad shoeing which contracts the foot, but this could not happen, if the double-jointed shoe was used.

On permanent Grass Pasture.—Farmers Mag. No. 53.

The writer observes, that nothing strikes a traveller passing from Scotland to England more forcibly than the beautiful verdure of the grass pasture: he states this not to be occasioned by the general superiority of the soil of England, but to arise from

the different management of the sweard land, more particularly from its top dressings with manures, and remaining many years in grass, where the soil is adapted for such practice; top dressing in the south of Britain being considered as the necessary means of keeping up the fertility of grass grounds, while in Scotland it is supposed wasteful, to expose putrescent manures on the surface, even when spread in the proper season, and in the best manner. The English custom, however, is said to be the practice recommended by the ancient Roman authors on agricultural subjects; and the writer adds 'Let the Scotch farmer but try a top dressing on one small field of dry subsoil, best adapted for grass on his farm, and it is probable he will not regret the expenditure of his manure, as it will give an abundant return of herbage.'

Observations.—If the feeding of large cattle for the market were to prevail north of the Tweed, the Scotch farmer would feel the necessity of giving some of his manure to his grass lands, which is however not necessary, where all the beasts on a farm are merely breeding stock.

Account of culture of Fiorin in Lancashire; by Mr. JOHN BAIRD.—*Farmers Mag. No.* 54.

THE Fiorin was planted in part of a field which had been potatoes the year before, and which was intended for barley; the planting took place late in the spring; the quantity was about an acre, and the strings were strewed over the ground and rolled in in the usual manner The whole was afterwards top dressed with ashes about the end of May, taken from the iron-works and lime, on separate ridges: the best crop was on the ridges, dressed with coal ashes. The grass, when nearly cut, weighed after the rate of ten tons two hundred weight per statute acre; the hay was overdried, yet the horses were very fond of it, and eat it with avidity, and made no hesitation to reject the best rye-grass hay for the fiorin hay. The success of this experiment has induced Mr. Baird to make preparations for planting fiorin on a larger scale.

Observations.—This trial in Lancashire affords additional proof that fiorin may be beneficially cultivated on cold hilly situations; and perhaps the great superiority of this grass consists in its being adapted for situations, where the finer meadow grasses will scarcely grow at all.

Account of several unsuccessful attempts to reclaim Flow-Moss for cropping. By Mr. F.—*Farmers Mag. No.* 54.

SIXTEEN years ago the writer began an improvement of a flow-moss from six to twelve feet deep, which bore nothing but a stunted kind of heath, and a dry white fog; he was induced to make this attempt by the publication of a successful attempt by Mr. Smith, on Swinridgemuir Moss, and hoped therefore by following the same methods, to get it soon converted into profitable arable land. The first crop, as recommended, was potatoes, and great was the mortification on finding that the produce was scarcely worth digging. Judging however that the moss would be ameliorated by the failure of this crop, the following year he planted potatoes again with a little fresh dung, and carefully weeded them during the summer; but with very little better success than the first year. And being still unwilling to relinquish the attempt, he availed himself of the opportunity of a frost, and carted from a hill of freestone gravel as much as covered a part of the moss to the thickness of an inch. This part was then dunged and planted with potatoes, but afforded a very inconsiderable produce; the same year oats were sown on the piece which had been twice cropped with potatoes, and the crop was very poor. The whole was sown the following year with oats and grass seeds, and a good dressing of mould given to the gravelled part; here the oats produced about four bolls to the acre, but there was scarcely any corn on the other part; and the grass was very little. The project was then relinquished as to the first part, and it is again become heath; and the gravelled part, as it adjoined an arable field, has been continued in cultivation, but has scarcely met the expenses.

Observations.—We should be glad to see more unsuccessful experiments recorded, as they serve as beacons to warn others from falling into similar errors; to make known the failure of experiments is quite as beneficial to the public, as to publish successful attempts.

On the management and produce of Dairy Cows, by a Plebeian.—Farmer's Mag. No. 54.

IT stated that very few cows produce to their full weight of cheese, or to the value of £.22 in milk, to do which they must be uncommonly well fed, and the milk sold at the highest rate. Such statements are represented as injurious both to the landlord and tenant, since they give rise to expectations, which can-

not on a general scale be realized. An instance of dairying is given on a high situated farm, without inclosures or planting of any kind to give shelter, where an attempt was made to keep a dairy on a small scale. As soon as the land was sufficiently improved to produce a full bite, two or three cows of the dairy breed were purchased, but these suffered so much from stormy weather as not to answer in such an exposed situation; and some cows bred upon the high lands were then obtained, and a succession was kept up by rearing the calves bred by them. The produce of eleven cows, which were well fed and kept in good condition, was £.133 4s. 9d. exclusive of the milk made use of in a family of fourteen persons.

Observations.—We entirely agree with this anonymous writer, as to the general injury arising from the publication of rare instances of extreme fertility in any agricultural production, while the average and usual produce is kept from public notice. For proprietors, who are not of themselves judges of land, are too apt to listen to these speculative writers, and to calculate upon their positions; and in too many instances they find tenants, who imagining they can manage as well as others, accede to agreements which cannot be fulfilled; and hence the source of disappointment to both parties. The extreme produce of any part of a farm ought not to form the criterion of calculation for the produce of the whole, which is always much less in proportion, than that which excites particular notice.

Rules for ascertaining the Age of Horses by inspection of their Teeth. By F. G.—*Farmer's Mag. No.* 54.

The rules given in the narrative are compressed into the following recapitulation:—*At from* $2\frac{1}{2}$ *to* 3 *years old,* a horse sheds in both rows the two centre teeth, and is then said to be a three-year-old.—*At from* $3\frac{1}{2}$ *to* 4 *years,* he loses other four teeth, one on each side of those he lost the preceding year, both in the upper and under jaw, having the four outside or corner teeth remaining; he is now called a four-year-old.—*At from* $4\frac{1}{2}$ *to* 5 *years,* the four corner foal teeth are cast, and then he passes for a five-year-old; at full five years the flesh disappears, and the corner teeth become complete shells, hollow within, and the tusks have pierced the gum, and their points may be felt with the finger.—*At from* $5\frac{1}{2}$ *to* 6 *years,* the tusks become of a moderate size, sharp, the insides fluted, and the edge next the gatherers thin: he is now called six-year-old, which is the most valuable age.—*At from* 6 *to* 8 *years* all the gatherers are full,

having only a brown speck on the top, the corner teeth have become much thicker, and the tusks longer; but as the speck remains with many horses for several years after, a person who is not a judge, will be told that the horse is not more than six years old.—*At* 8 *to* 10 *years and upwards:* at eight the bean being generally worn out from the teeth of the under jaw, the upper jaw may be examined; at nine the speck of the centre; at nine and a half that of the middle; and at ten, that of the corner teeth is effaced. then the horse is said to be *aged*, and to have lost all mark.—The age can no longer be distinctly known from the teeth, but a probable conjecture may be formed from the length of the tusks.

Observations.—Since there is no part of the farmer's stock more expensive, nor any in which he is more subjected to imposition than horses, we trust we shall stand excused by the more intelligent part of the Agricultural public for noticing this paper, in order to convey the information it contains, to the young and more inexperienced reader, who will the easier understand the subject, from its being elucidated systematically.

On the Origin of Potatoe Oats. By Mr. Francis Sibson.—*Farmer's Mag. No.* 54.

It is stated that this valuable variety of the oat, was first cultivated by Mrs. Jackson, formerly of Threepland, in the parish of Terpenhow, in Cumberland. A Mr. Hislop, who was then a farming servant with Mrs. Jackson, was reaping a field of wheat in 1788, and was struck with the appearance of some oats, which he observed growing promiscuously with the wheat, and considering them to be the nicest he had ever seen, he shewed them to Mr. Daniel Jackson, and they resolved to preserve them. The stalks on which they grew, had proceeded from only a single grain. They were forgotten in 1789, but were sown in 1790, and the produce was three quarts: in 1791, the produce was three Carlisle pecks: and in 1792, four. In 1793 some of them were sold to Mr. Thornthwaite, Mrs. Jackson's son-in-law, who called them *Potatoe Oats*, from an erroneous opinion that Mrs. Jackson first found them growing among potatoes. This account is said to have been received from Mrs. Jackson, Mr. Jackson, Mr. Hislop, and Mr. Thornthwaite, and to have been committed to writing in their presence. And as the greater part of the seed wheat used in Cumberland is obtained from the London markets, it is deemed probable that the original seed came either from Kent or Essex, particularly as the

description of the Essex oat corresponds with that of the potatoe oat; and the circumstance of this latter oat not flourishing well in the neighbourhood of London, is not considered an objection of any moment, as that may be sufficiently accounted for from the difference of soils.

Observations.—If this account be correct, and there appears to be every necessary internal evidence of its correctness, since the names and residences of all the parties concerned are fully given, it is a curious circumstance, that so valuable a variety of that grain as the potatoe oat, should owe its introduction to mere accident. And praise is due to the parties, for their care in propagating the variety unmixed.

On planting and rearing Thorn Hedges. By Mr. William Aiton.—*Farmer's Mag. No.* 54.

Thorn hedges are represented to be, of all other fences the cheapest, most beautiful, most durable, and most valuable yet known, and that no other ought to be formed, where these can be made to grow: and that it is not the richness of the soil, but its quality for retaining moisture, and the manner in which the dykes are formed and kept that govern the growth of these hedges. The whole art of raising white-thorns into a fence, is said to lie in placing them within the reach of a due supply of moisture, the benefit of the sun and weather, and in keeping them from being overgrown with weeds; the luxuriance of their growth depending on their obtaining more moisture than is required for the generality of trees and shrubs, and the stuntedness of hedges in nine cases out of ten, proceeding from the want of a due supply of moisture. Whenever a thorn fence is attempted to be raised on a dry or a sandy soil, the trench should be opened on the lower side, and the dyke reared on the rising ground, that when heavy rains fall, the moisture may run to the root of the thorns; while if the trench be formed on the higher ground, it would intercept and carry off the water; and whenever a thorn hedge is planted on a dry sandy soil, the thorns ought to be placed low in the dyke, and great pains taken to keep them free from weeds. When thorns are planted in a dyke formed of sterile moss, they are found to grow as well for two or three years, as if planted in rich mould, but whenever the moss is divested of moisture, they become stunted and soon die, unless means are taken to supply that necessary nourishment.

In order to make a fence at once sufficient to turn cattle, the

author directs that a trench five or six feet wide, and three or four feet deep, be dug, and not only the earth taken from it, but a considerable quantity of turf dug up on the other side, and the whole formed into a dyke several feet high, tapering narrow at the top; and the thorns have a sufficient degree of moisture for a long time after they are put in; but as the dyke is raised high, the water will not run to the roots, unless there be a trench at the back part, which should be kept open five or six years, and sometimes this proves ineffectual. It is recommended therefore to make but a moderate trench in front of the dyke, and not to raise the top of the dyke too high to exclude the sun from the roots of the thorns; and though this may require additional forcing to guard it at first, yet it will become much the more secure fence in a course of years.

The notion of thorns, or any other plant, being killed when their roots reach the cold subsoil, is treated as a mere conceit; since nature has taught plants where to strike their roots in search of the most nutritive food, and if every plant died when its root reached the sterile subsoil, none would be found alive after a few years. But it is not in clay soils, says Mr. Aiton, or where the subsoil is a cold clay, that thorns die soonest; but that happens much more frequently in dry, sandy, or gravelly soil, or in dry rocky parts, where there is no cold soil of clay within reach of the roots; and the failures in growth which are supposed to proceed from the roots reaching a cold subsoil, proceed nine times out of ten from want of moisture.

It is also noticed, that hedges are seldom dressed in a proper shape, being either permitted to rise like trees, and their bushy tops to overshadow and kill the smaller branches near the roots, or else having the lower branches lopped off, in order to straiten the hedge, while the tops are allowed to remain. To prevent this, it is directed that the hedge, after it rises three or four feet high, be kept thin at top, in the form of a wedge, and the lateral twigs allowed to spread out near the ground, to the breadth of eighteen inches or two feet, and the hedge tapered on both sides. And when this is done, the heat, light, dews, and rains, fall upon the parts of the hedge equally, and the thorns grow as close at the root as at the top.

Observations.—These remarks may appear trivial to some of our readers, but many thorn hedges have failed for want of proper attention to the planting and rearing them. And it is an important part of agriculture, to obtain fences at once fully adequate for the separation of cattle, and affording shelter from the storm.

On the Management of Wool, while in the Hands of the Farmer.—Farmer's Mag. No 54.

The first process mentioned in the management of wool, is to have the sheep carefully washed in a pool of running water, as soon after Whitsuntide as the weather will permit; and as this operation is intended to free their fleeces from the dirt and sand which adheres to them, they should be repeatedly plunged over the back in water, and the wool rubbed with the hand on the back and sides, to assist the water in reaching their skins. Upon coming finally out of the water, they should be taken to a dry part of the farm, and not suffered to go near broken banks or rugged ground, when sand might be again rubbed into their dripping fleeces; and it is thought desirable that the washing should take place early in the morning, that they may derive some benefit from the influence of the sun when the washing is over. The wool, at shearing, should be cut quite close to the skin, because it feels more kindly towards the bottom of the pile, and has a fresher appearance: and it weighs heavier, for even a trifling addition to its length adds to the weight of the fleece; and also more ready access is opened for the application of any ointment or liquor to the skin which may be necessary, for the destruction of vermin; and of all dressings, common oil is reckoned the best for the carcases of new-shorn sheep, as tobacco-liquor often sickens the animal, and is unfavourable for promoting the growth of wool. This is said to have been tried by a farmer in Selkirkshire, and the wool sprung luxuriantly, and was so much heavier than that of the other part of his flock, as not only to indemnify him for the expense, but to afford an extra profit.

All fleeces, after being clipped, should be wrapped up in a neat compact form, by folding in the sides, and rolling them up from the tail to the neck, that the various qualities of the wool may be seen without opening the fleece; and if they are kept long by the grower, they should be frequently turned over and exposed to the fresh air, or in a very short time moths will find their way into pure white fleeces, and even the greatest care in airing them, will scarcely preserve them a year from the depredations of these vermin.

The new growth of wool springing up on sheep, raises the old from their skins, and would gradually throw it off without much aid from the shears; here then nature is said to point out to the operator where to clip the fleece, and shearing should not be delayed too long after the new wool begins to grow, for fleeces handle more fresh and kindly after the bottoms begin to spindle,

and a new growth to arise; and the longer they remain on the carcase after that period, the more harsh they become, and unpleasant to the touch.

Observations.—The directions here given are very unimportant, and so obvious, they could not escape any person of common understanding: the outline therefore is only selected for notice; a lengthened discussion of seven pages on turning, smearing, and oiling sheep, would not have repaid the trouble of detailing even its substance.

On Manure. By SIMPLICITUS.—*Farmer's Mag. No.* 54.

A wide diffusion of the best methods of collecting, increasing, and managing manure, is considered of the greatest importance to the general interests of Agriculture; and it is contended, that the advantages derived from the toil and labour attending this object, will be fully compensated by the advantages derived from it.

The direct operation of dung upon land, is inferred from seeing that rich dung, after lying twelve or eighteen months in the dunghill, gets into the nature of a fat or slimy substance, which by mixture with sand or gravel must, to a certain extent, assimulate such soils to the nature of rich vegetable mould; and indeed, by resolving itself into pure vegetable mould by putrefaction, if kept a sufficient length of time. And admitting the usually received position, that no farm can raise annually, a quantity of dung more than sufficient to cover one-fifth of its surface with manure: hence is assumed the necessity of increasing and augmenting this given quantity, by every means which experience has shewn to be effectual, or which human ingenuity is able to devise. The advantages then of compound manures being admitted, the writer goes on to state, that the ingredients of the composition may be farm-yard dung, earth, lime, weeds, ashes, soot, sea-weeds, marl, leaves, haulm of peas or beans, straw, heath, prunings of hedges, saw-dust, refuse of flax, moss, animal exuviæ or blood, offals of fish, the carcases of horses, dogs, &c. sweepings of mills, shavings of horns, broken or ground bones, offals of tan-yards, soaper's ashes, refuse of whale blubber, or other adventitious substances; and he is inclined to think that none of, not even farm-yard dung, can be applied by itself to land with the greatest advantage, since by mixture with other substances, besides increasing the quantity, it imparts and receives qualities which would not otherwise go to the soil. The writer states an instance of a field of early barley, one half of

which was dunged with common farm-yard dung, and the other half manured with a compost of earth, ashes, and dung, well mixed together; the crop of the latter half was much more strong, luxuriant, and productive, than that which was manured with the farm-yard dung alone.

The time is anticipated, when manure will only be applied in the shape of compost, and the cleanings of post roads or thoroughfares are mentioned, as containing more vegetable matter than persons are apt to imagine; the following practice is given as very adviseable: let a quantity of lime called dreg be procured, and being well watered, after making the bottom of the compost of road cleanings, or scourings of ditches, about nine inches thick, let it be sifted on the surface with riddles, till the surface be covered with a fine powder; after which a layer of farm-yard dung should be given, and then a layer of earth or road-cleanings six inches deep, and then another layer of sifted lime, and so on alternately; and intermediate layers of weeds, old thatch, or other similar substances, will be found beneficial additions to this compound; which after having lain six or eight weeks, should be turned over from one end to the other, and laid as loose as possible, the more speedily to effect the heating, and encourage the tendency to fermentation.

The question, how long manure should be kept with the most advantage to the land, though a very important one, is thought to be not yet quite satisfactorily determined; some animal dung being kept till reduced to one-third of its original bulk, and sometimes to the state of rich earth. A small field is noticed, which being nothing but sharp sand, little or no crop was expected from it when ploughed up: but it had been the seat of dunghills for a number of years, and most extraordinary crops were obtained from it for three years successively, without any assistance from manure; and from this circumstance an inference is drawn, that all substances have a tendency to part from their spirit or acid after a given time, and that all inert substances lose their principles by keeping; and he is of opinion therefore, that the sooner manure is applied to the land, the more effectually it will communicate that principle in its native strength. And if dung did not lose its strength by keeping so much as it does, it is still insisted, that in all such porous substances as dunghills, moisture falls to the bottom, and carries with it the more valuable particles of manure. And it is conceived to be from this principle, that the great fertility may be accounted for, which always follows the trenching or turning up of deep soils, which have lain beneath the reach of the spade or plough for a length of time, and have thereby received a part of the deposit, which the upper soil has lost. And hence

also is adduced the necessity of excrementitious manure being combined with alluvial or other earth, in order to retain the substance or strength of the former, which would otherwise sink and be lost to the crop; and even shells and lime are said to subside gradually in the soils on which they are laid. And though great crops have been obtained, on those farms where sea-weed has been applied, it is yet contended that its effects are immediate, and are little known the second year, while the effects of dung and excrementitious manures, are protracted to four, five, and six years.

As to distance that putrescent manure should be carted with advantage to the farmer, it is doubted whether it would ever be profitable to cart it more than ten miles, unless it can be purchased at less than 6s. per cubic yard, and all extraordinary distances which manure may be carted, is only considered as proofs of what can be effected, when wealth and refinement assume Agriculture as an amusement, and do not view it as an object of profit.

It is thought adviseable in every farm-yard, to scatter the hotter and more pungent dung, as that which comes from swine and fowls, over the common dung-hills: as the heat arising from its fermentation, will hasten the decomposition of the general mass. Top-dressings are held to be the most efficacious of all methods, for producing rich and nourishing permanent pasture, which will never be procured in a verdant and luxurious state by any other means, as this immediately goes to their roots, and serves the purpose of both hoeing and manuring: and these may be obtained to any extent, by the mixture of lime and earth, without encroaching much on the yard manure.

An instance is mentioned, of the application of human excrement, obtained from barracks, which was mixed into a compost with five times its quantity of earth, and when well incorporated, applied to a field sown with spring-wheat and grass-seeds; the wheat was uncommonly strong, and yielded well to the acre: and the grass-seeds, the following summer, were amazingly luxuriant. Saw-dust is also noticed, as a manure little used, and indeed little deserving to be used, since it was found very slow and ineffectual in its operation, except when mixed with animal dung, with blood, or with the sweepings of slaughter houses.

As a matter of curiosity, some attempts were made to ascertain the weights of manures: a cubical yard of garden mould was found to weigh 19 cwt. 3 qrs. 25 lbs.; of water, 15 cwt. 7 lbs.; of compost of earth, weeds, lime, and dung, which had lain nine months and been turned over, 14 cwt. 5 lbs.; of new dung, 9 cwt. 3 qrs. 18 lbs.; of leaves and sea-weed, 9 cwt.

7 lbs. The weight of water being to that of mould nearly as three to four, and water to new dung, nearly as three to two.

Observations.—There was no occasion for the writer of this essay to have withheld his name, as it is creditable to him, both as an agriculturist and an author. In a limited compass, it contains a greater mass of information respecting manures, than is generally met with; and though it certainly follows the elaborate volume of Sir Humphry Davy on the same subject at an immeasurable distance, yet the information and instruction to be derived from it, will amply repay the trouble of an attentive perusal.

On Fallowing;—by a Dengy Hundred Farmer.—Agric. Mag. New Series, No. 1.

On Fallowing; and the point at issue with a Dengy-Hundred Farmer; By C. M.—*Ibid. No.* 2.

On Fallowing; By Mr. HOLDITCH; *in reply to* (C. M.) *Cultivator Middlesexsiensis.—ibid. No.* 3.

Winding up the preceding question, in answer to Mr. HOLDITCH. *By Cultivator Middlesexsiensis.—Ibid. No.* 4.

THE point of controversy in these papers is the necessity, utility, and importance of a summer fallow. In the first the Dengy Hundred Farmer observes, that light soils easily cleaned; and upon the same description of Essex heavy lands, there is no excuse for an unproductive or whole summers fallow; but he thinks that upon such lands as are poor, almost without means of improvement, periodical fallows can scarcely give place to any other management; and he seems to point particularly at lands of such poor description, as will neither produce cabbages nor any other cattle crop.

The idea that a naked and unproductive fallow, as such, is necessary to any land, seems to the Middlesex farmer as libellous to agriculture in a very high degree, if not treasonable, and accordingly in the following number of the Magazine, he enters the lists of controversy, and remarks (after much sneering) that some thirty or forty years since, when the following question was tried, both upon paper and poor land it was proved, that the exposure of land, naturally poor and exhausted by cropping, to the heat of the dog-days sun, had the effect of still farther exhaustion, and that such land shaded by a crop of some species was invariably more productive in the ensuing season, than after a naked fallow;

and he refers to Young's Annals as an authority for his position. Many years since, he admits that he expressed an objection to this opinion, merely so far as to question any danger from the sun, unless the soil consisted of pure sand, and he acknowledges not to have yet observed those injuries to land from the solar heat, on which the old anti-fallowists used to lay such stress; but he contends it does not militate in the smallest degree against his present position; for he asserts the point at issue to be, whether a piece of the poorest land under arable cultivation, clay, loam, or sand (and not supposing imperfect farming) shall have been cropped during the regular period previous to fallow, but in the mean time cleaned to perfection by the hoe, so that at the time stated it shall need no fallow on the score of cleaning, nor producing any weeds at all, shall yet stand in need of, or be benefitted by, a naked unproductive fallow, presenting the exposure of its shame of barrenness to the whole agricultural world? And he argues, that there being no weeds to fallow away, the plea of fallow required must be that the poor wearied and exhausted soil, which will yet carry timber and grass to eternity, must have an unproductive sleep of some months in order to its recruit for corn; and insists that in no case within his observation (and many has he seen) has such recruit been worth the expense, or any ground at all lost by the substitution of some of the lighter crops.

Mr. Holditch, noticing the two preceeding papers, assumes that there is merely a shade of difference respecting fallowing between the Dengy Hundred farmer and cultivator Middlesexiensis, and he deems the slight variation rather incidental than essential; the question being not whether fallow on poor tenacious cold land be *necessary* (supposing such land to be clean from root weeds) but whether it be not *expedient* in a rotation of years; or in other words, whether a rotation of crops of six years would not produce more net profit to the occupier, supposing one year of the six to be a fallow, than without it? Mr. Holditch thinks it would; but at the same time C. M. might think otherwise; but at any rate it must take six years to prove it with fields of one quality equally well managed under either system.

Cultivator Middlesexiensis, considers Mr. Holditch to have allowed that he himself does not view *fallowing in the light of a principle of fertility*, and deems this admission sufficient to establish his own positions.

Observations. This controversy was doubtless very entertaining to the respective parties, who appear to us to be the only persons likely to derive either pleasure or advantage from it.

On the Culture of Turnips. By N. M.
Agricultural Magazine, N. S. No. 2.

THE writer states these observations to be the result of an extended acquaintance with the different modes practised in various parts of the Island, and with their respective advantages. The best soil for turnips is represented to be a dry and light soil, which should not be merely dry on the surface, but the sub-soil ought also to be of a dry nature. And though turnips may be grown on a strong, and even on a wet soil in very dry seasons, yet the chance of a good crop on such soils is very small indeed. And even should a good crop be obtained in such soils, its consumption would be difficult, for though land of this nature may in a dry summer be sufficiently dry for the growth of turnips, yet it must be wet on the approaching winter, so that sheep cannot be put on it to feed the turnips off, nor can carts go over it to take them away, without poaching it extremely, an injury probably of some years duration. And with regard to the preparation of the soil, it is probable that turnips would succeed equally well after any crop; but as they are regarded as a fallow crop, they are usually sown on land, which has run its course in the rotation, and been more than once previously ploughed; from which circumstance, less stress has been laid upon pulverizing the soil as much as posible; though it may safely be laid down as an axiom in turnip culture. Indeed it should, if possible, be ploughed the first time before the winter, since this ploughing exposes the soil to the action of the frost, which will help much to pulverize it; and the second ploughing may be given early in the spring, and should be across the land, and deeper than the first; after repeated harrowings, the third ploughing should be given, and again succeeded by harrowing, and all weed-roots carefully removed. And the writer conceives that the crop would be greater, both in quantity and quality, if the land was limed, which ought to be done whenever it is reduced to a state of sufficient fineness and cleanness, and the quantity should be about 300 bushels per acre. Land intended for turnips, ought also to be well dunged, which is still more necessary than liming; and, perhaps manure applied to no other crop answers so well or affords so much profit, as when applied to turnips; since not only the turnips will be better, but likewise all the succeeding crops in the rotation; and that nearly in proportion to the quantity of manure. With respect to time in sowing turnip seed, much is said to depend on the climate: in Scotland and the north of England, the beginning of June is deemed the most proper season; but in the south of England, the middle of June is thought much too early; for turnips sown then will not stand the winter, as they will begin to form their seed long before they can be eaten; yet there is risk in deferring the sowing to July, lest the dry weather

should set in so completely, that the plants would not come up regularly, or be attacked by the fly; in either of which cases, they would not be a heavy crop. The question as to the month of sowing, whether broad-cast or in drills, is left to be determined by future fair experiments; but the writer remarks, that it by no means follows, that turnips sown in drills should therefore grow on ridges, which is objected to, on account of exposing their roots more to the weather; and though the comparative weight of crop may be put out of the question, yet from sowing in drills, the advantage is obtained of easily and cheaply cleaning the land, by means of the horse-hoe, while in a broad-cast crop, the hand-hoe only can be applied; and he scarcely thinks it necesary to point out or insist upon the advantage to the cross and the ground, which must result from careful and repeated hoeings, in whatever mode the crop is sown. It is also remarked, that in England, turnips are usually consumed by sheep, and the crop eaten on the ground, while in Scotland many oxen are fed on them, and even when given to sheep, they are taken off the ground, and carted to a clover field; but the writer thinks a fair trial has not been made in England, of feeding oxen with turnips alone, nor as to viewing the manure made by cattle in the stall, as a supply to be returned to the ground from which the crop is taken; though he admits consuming them on the ground, is a certain method of securing the manure there. And as to crops which should follow turnips, he has no doubt but that barley answers best, and that a larger crop of it will be obtained, than of any other grain, and that it will leave the land in a better state for other crops; but he thinks that whatever crop is sown after turnips, clover ought always to be sown along with it, for which turnips is the best possible preparation.

Observations.—These remarks on the culture of turnips, are founded on the soundest reasoning, and are the result of much observation. They contain more information on the subject than has yet appeared in any agricultural publication.

On the field culture of Hemp, by q. M. S. Suffolk.—Agric. Mag. N. S. No. 2.

In this paper hemp is recommended as a regular crop on the farmer's list of general culture, but the writer that he should, before adopting it as such, have regard to whether the legislature offer a sufficient encouragement to its growth, he having a convenient market for the disposal of it, and the general quantity of manure he is capable of affording it, with other local matters

that depend on soil and situation. The soils considered most appropriate to the mixing of the hemp crop, are all those of the black deep putrid vegetable kind, which a situation low and rather inclined to moisture afford, as also the deep mellow loamy and sandy sorts; though hemp may be grown with success on land of an inferior quality, particularly where manure is not dealt out with a sparing hand. It is said to be grown in Suffolk on almost all the varieties of soil the county produces, but is found the most profitable on the best soils; old meadows and low bottoms near rivers being preferred. The mode of preparing the land for the reception:—This crop is by bringing the soil into a fine mellow state, and perfectly clear from weeds; for which purpose three ploughings, with suitable harrowings, will be found necessary: prior to the seed ploughing, the manure is carted on, spread and reduced as fine as possible, and it is reckoned false economy, to be sparing of this article: the freshness and quality of the seed should be closely attended to, as well as its weight and brightness of colour; it is generally sown broad-cast, and should be distributed very evenly over the land. If hemp be sown with a view to a *seed crop*, the writer recommends drilling it, at such intervals, as to be able to use the horse-hoe: but, if sown with a view to the superior quality of the yarn, he would sow it broad-cast; for he does not find in his own practise, that good hemp for seed and good yarn, are to be attained by the same crop: for when he has let the crop stand for seed, the hemp has not turned out, fit for any other use, than for rope and twine spinners, and other coarse purposes. The best period for sowing, is said to depend on the wetness or dryness of the soil; and on dry soils, perhaps the earlier the seed is sown in April the better, but where the soil is of a moist nature, May is considered the best seed time. Hemp is found to grow after any other kind of crop, if well manured for, and may be cultivated on the same ground, for many successive years, though varying the crop by an alternate change, will produce a more valuable return. This crop requires guarding from birds, with more than ordinary care, which is an argument in favour of drilling the seed, but from its thick and tall foliage, allows very few weeds to flourish. When the crop is considered ripe, which is generally in about fourteen weeks from the sowing, and which is known by its having a pale whitish yellow colour, and the leaves beginning to fall from the stems, it should be pulled; and the male and female ripen at different times; each should be pulled when in flower, if the yarn only be regarded, but the female plant should stand till the seed be somewhat hardened, if the seed be intended for sowing at a future year. The method of pulling, is by the hand, by small

parcels at a time, and by giving the lower end of the handful a slight blow against the workman's right foot, to free the hemp from the soil, which otherwise would adhere to the roots; the handfuls are then to be tied up in small bundles, and piled in shocks, in any form agreeable to the grower. After being left in this state for some days, it is further prepared for the manufacturer either by *dew-retting* or *water-retting*; by the former mode, a finer hemp is produced, making a difference often of 3s. per stone in the value. In dew-retting the hemp immediately after being pulled should be carried to a level meadow, and there spread out in an even regular manner, and turned three times a week for a month or six weeks; and as soon as the hempy substance become easily separable from the woody parts, it should be again tied in bundles as at first and put away for use. When the seed hemp is ripe, it is recommended to carry a sail cloth to the field, and when the hemp is tied in bundles to cut the heads off into the sail cloth, treating the stems as before directed; which will prevent much injury by thrashing, and any damage done by sun or rain, which would injure and discolour the hemp if it stood to be dried on the stalk. To prepare the hemp for the heckle, it must be first broke then swingled, and lastly beetled; and though this work is best performed by machinery, it cannot be done without much loss of seed. The acreable produce when made ready for the heckle, is said to vary from thirty to fifty stone, of 14lbs. to the stone; and the price to vary from 6s. to 9s. per stone. The expense of cultivation per acre is thought to be about nine guineas, and the value of the produce about sixteen guineas; giving a profit of seven guineas per acre to the grower. This writer therefore considers it obvious from his statement, that that though the expense of cultivating this article is considerable, still that the produce amply repays the expense, and that the farmers may with confidence look to a hemp crop for a profit, if proper encouragement be afforded, and a market near at hand.

Observations.—These instructions by a practical grower of hemp, will be duly appreciated by every one who is inclined to introduce its cultivation among his other crops; and we do not know where to point out directions for its culture, which possess less of the reasoning of theory, or more of practical utility, than those contained in this paper. In a situation where the cultivation of hemp is most extensively practised, it is of very great advantage to the poor, by affording much employment both for themselves and their children, in all seasons and at all times:

while the power of preparing it for the manufacturer, being within the reach of each separate family without herding with others, holds out no temptation to vice or immorality. These circumstances speak forcibly for its more extended adoption; and we do not consider it would be advancing too much to say, that it would be a great national benefit to have its growth extended by legislative encouragment; since it is in itself the most important article of our importation from foreign countries, and is an excellent preparation for a wheat crop, the kind of grain most desirable to have increased at home.

On Bean Husbandry; by a Dengy Hundred Farmer.—Agric. Mag. N. S. No. 2.

WITHOUT presuming to offer any thing new, this constant correspondent of the Magazine submits a few particulars, relative to the planting of beans. Putting them in with a drill he considers a very unequal mode of delivering the seed, and consequently too objectionable to be continued; and preference is given to putting the seed in with the dibble: the width of the rows in this practice is spoken of as arbitrary, but it is deemed most judicious to plant four rows upon eight furrow stitches, as this leaves an interval sufficient for any small plough or horse-hoe: it is admitted, however, that this judicious method has not been followed either by this writer or his neighbours. The quantity of seed used are said to be the same whether four or eight rows are planted on the stitches, it not being an object to aim at saving much seed, where beans are seldom a very productive crop, the best not averaging more than four quarters to the acre; but this deficiency of crop is attributed rather to late sowing than to any other cause, as the produce of the straw is always considerable. January is named as the best month for sowing beans, and the practice of early sowing for peas is said to be still more commendable, as they are thereby placed more out of the reach of destruction in the summer.

Observations.—These strictures give farther sanction to what is commonly noticed and acknowledged, and yet practically but little regarded;—we mean the general superiority of early sowing spring crops, for as the warmth of summer comes upon the young plant too early, and urges premature luxuriance, it is always fatal to the due production of the grain. And this applies more particularly to the whole of the pulse species, since these require a greater proportion of moisture in their early growth, in order to ensure maturity, than any other kind of corn crop.

On the relish of Stye-Hogs for Cinders, and on Indigestion in Animals; by a Feeder.—Agric. Mag. N. S. No. 2.

The propensity which swine, when confined and full fed, have to cinders, and all similar substances, is attributed to having their stomachs overloaded with sower wash, which is frequently given them in preference to sweet wash by many feeders, from an idea that acidity increases their appetite, and renders them more craving after food. It is remarked that these irregularities of appetite may be observed in all animals confined upon a full diet, more particularly in suckled calves, who from the constant prevailing acid on the stomach are ever craving of chalk, clay, or any thing of an alkaline and absorbent quality. And while it is admitted that the idea of indigestion in hogs and other animals may appear to some highly ridiculous, it is yet insisted that nothing is more common. "The best feeders, it is said, in the regular way diet their hogs always as nearly as possible, apportioning their food to their appetites, so that their troughs are usually after a meal quite empty and clean." And it is contended that the particular preferences of animals for unusual food at particular times is often directed by an instinctive appetite, which tends to forward some useful process in the animal economy, and imparts something beyond the mere pleasure of eating.

Observations.—The attentive observer of nature, and of the instincts of animals, which are ever directed in some way or other for their preservation, must admit the accuracy of the positions laid down in this paper. And as to the mode spoken of, as adopted by the best feeders of hogs, we are sure that such of our readers, who have as yet contented themselves with the common practice of keeping the trough of a feeding hog always full, will have no cause to regret the change of the plan, if they can be induced to make a fair experiment of the method here recommended.

On the culture of drilled Beans; by Mr. Booth.—*Agric. Mag. N. S. No. 3.*

In the spring of 1812, horse beans were planted by Mr. Booth in a field, which had been marled about ten years before, and the marling succeeded by two crops of white corn, and laid down with clovers and other grasses, in which state it had continued for six years, and had constantly borne hay-grass, which had been mown every year, and but moderately manured. The seed beans were very

small, not less than 80,000 to the bushel; they were dibbled in drills 28 inches asunder, at first at four inches distance in the drills, and afterwards at three inches; the dibbling was from the 5th to the 11th of April, after which cold easterly winds prevailed till the beginning of May. For some time after the beans came up they appeared short and looked miserably; the intervals however were well worked and ploughed five times, at different periods, with a plough rather smaller than the common plough, drawn by one horse or mule singly, and the rows were hand-weeded twice, though but imperfectly; and as it was said topping beans would improve the crop, Mr. Booth topped them all, but not till the winds had broken or bent some of them down. In the operations of ploughing late between the intervals, and cutting off the tops, much apparent damage was done to the crop. The beans were reaped with the sickle, but from the inattention of the workmen many were shed on the ground. The whole were thrashed by hand, and the acreable produce was fifty bushels and a gallon per statute acre.

Observations.—This very large crop is an instance much in favour of drilling and dibbling beans at such intervals, as that a plough may work easily between the rows; for not only this enhances in a great degree the quantity of produce of the bean crop, but is at the same time an excellent preparation of the soil for wheat, which may after the harvest be drilled or dibbled in the middle of the intervals between the bean rows, which may even be manured, while the bean crop is on the ground; more especially if the rows are planted at the distance of 30 instead of 28 inches; and the crop would then be equally productive.

On Thracian, Siberian, or Spring Wheat.—By Mr. John Lawrence.—*Agric. Mag. N. S. No.* 6.

This Gentleman is the author of the New Farmers Calendar; and in a passage, of an early edition of that work, he had asserted, that "any wheat sown in March, in a good soil, would produce a small crop at harvest, which being re-sowed at the spring, would succeed better as spring wheat, and perhaps equally as well as that properly so called." This opinion had been controverted in the first number of the new series of the Magazine, and Mr. Lawrence admits that his subsequent experience has clearly demonstrated a specific difference in their natures and habits between wheat sown as above stated, and the true spring wheat, the latter having apparently full two months

start of the former in maturity of vegetation. And it appears to him, from the various experiments he has attended, that from the second week in January to the same period in February is the proper late seed season, for autumnal wheat, which may then be expected to ripen in the following October; the spring wheat however may be reasonably expected to be ripe enough to cut in August.

He states the *Triticum Cestivum*, spring wheat, the Thracian wheat of Miller, to have been originally imported into this country from Siberia and the Crimea, and to be generally bearded, and to bear a wide and rough leaf like barley, having the straw inferior in size to that of the autumnal wheat; and he says, that many years since he saw several samples of wheat from Russia, which he now knows to have been spring wheat; the use of which was known to individuals in England as early as the Protectorate of Cromwell, though its extended culture has obtained but lately. In his experiments he has found that early sowing of this wheat has always ensured early reaping, and the amount and quality of the produce has frequently been as great as that of Lammas wheat.

Observations.—The public recantation of his mistake is creditable to Mr. Lawrence, and his remarks on the subject of the paper will be found important to the cultivators of that species of grain.

On English Fiorin Grass, from the experiments of Lord Rous; *by* Mr. John Lawrence.—*Agric. Mag. N. S. No.* 6.

Lord Rous had in 1809, and 1810, collected a sufficient quantity of plant of the *agrostis stolonifera*, to lay down three acres of land at the distance of a foot between the sets; this had become an established meadow, only one acre being mown in November, 1811, for the purpose of planting eleven, merely throwing it evenly over the land, which had been well cleaned after a crop of oats; these stolones took root universally, and in the ensuing spring, a complete meadow was formed. The quantity cut upon the new land in November and December, 1812, was about four tons per acre; and on the three acres previously made, from five to six tons per acre. One of the earliest observations made was, that cattle and horses generally seemed to prefer this to any other kind of grass or hay, and that the most advantageous mode of using it was, merely to cut and give it to the cattle when dried in the air, without the expense of regular haymaking. Experience, however, has not proved it to be deserving

of those high encomiums which has been passed upon it; for it was proved last Autumn, that no animal would willingly eat fiorin grass in a wet state; and in some seasons it is impossible to give it otherwise: and wet grass is always found in autumn, a washy and unsubstantial provender. But Lord Rous sustained a still heavier disappointment with fiorin, and in a particular application of it, on which he placed his chief dependence: as an improving winter food for lean straw cattle, till they could be turned into spring grass; but eleven store galloway oxen, which had been fed during a month upon hay of a coarser quality, and on which they were thriving, were withdrawn from that, and fiorin hay was substituted; they disliked the change so much as to eat soiled litter in preference, and after a month were in worse condition than when fiorin was first given them. Some milking cows shewed the same disrelish to it, but sheep and lambs did well with it.

Observations.—Fiorin may be profitable, and of great utility upon bogs, and may have its use as a winter green food, but it is evidently inferior to other grasses as food for fattening cattle.

More Last Words on the Subject of Fallows; by Cultivator Middlesexiensis.—Agric. Mag. N. S. No. 5.

On Rest; by the Dengy Hundred Farmer.—ibid.

On Rest not being necessary, but injurious to land; by the same.—ibid.

These papers are a continuation of the controversy noticed in the papers taken from preceding Numbers of the Magazine, in which no new facts, or new reasoning, is brought before the public.

Observations.—There are some persons, who think their personal consequence and importance very much enhanced, if they can but see themselves in print; and we cannot discover any other adequate motive why these two writers should load the pages of the Agricultural Magazine with matter, which affords neither information nor amusement.

NATURAL PHILOSOPHY, ARTS, MANUFACTURES, AND CHEMISTRY.

On a Periscopic Camera Obscura and Microscope. By W. H. Wollaston, *M. D. Sec. R. S. Phil. Trans. Part* II. 1812.

In the common Camera Obscura, in which the images of distant objects, are formed on a plane surface to which the lens is parallel, if the surfaces of the lens be both convex, and equally curved; and if the distance of the lens be such, that the images formed in the direction of its axis be most distinct, then the images of lateral objects are indistinct in a greater or less degree, accordingly as they are more or less remote from the axis The causes of this indistinctness may be considered as two-fold: for, in the first place, all parts of the plane, excepting the central point, are at a greater distance from the centre of the lens, than its principal focus; and secondly, the point, to which any pencil of parallel rays, passing obliquely through the lens are made to converge, is less distant than the principal focus. On this account, it is in general best to place the lens at a distance, somewhat less than that which would give most distinctness to the central images: because in that case, a certain moderate extension is given to the field of view, from an adjustment better adapted to lateral objects, without materially impairing the brightness of those in the centre. The want of distinctness, however, is even then only diminished in degree, but is not remedied.

The construction, by which Dr. Wollaston proposes, to obviate this defect, is represented in a figure, which accompanied the reading of his paper, in which are seen the essential parts of a Periscopic Camera, in their due proportion to each other. The lens is a meniscus, with the curvatures of its surfaces, about in the proportion of two to one, so placed, that its concavity is presented to the objects, and its convexity towards the plane, on which the images are formed. The aperture of the lens is four inches, its focus about twenty-two. There is, also, a circular opening, two inches in diameter, placed at about one eighth of the focal length of the lens, from its concave side, as the means of determining the quantity, and direction of rays, that are to be transmitted.

The advantage of this construction, over the common Camera Obscura, is such, that no one, who makes the comparison, can doubt its superiority. The causes of this, Dr. Wollaston explains. It has been already observed, that by the common lens, any oblique pencil of rays is brought to a focus. But in

the construction above described, the focal distance of oblique pencils, is not merely as great, but is greater than that of a direct pencil. For since the effect of the first surface is to occasion divergence of parallel rays, and thereby to elongate the focus, ultimately produced by the second surface; and, since the degree of that divergence is increased by obliquity of incidence, the focal length resulting from the combined action of both surfaces, will be greater than in the centre, if the incidence on the second surface be not so oblique, as to increase the convergence. On this account the opening is placed so much nearer to the lens, than the centre of its second surface, that oblique rays, after being refracted at the first surface, are transmitted through the lens, nearly in the direction of its shorter radius; and hence are made to converge to a point so distant, that the image falls very nearly in the same plane, with that of an object centrally placed.

In the use of spectacles by long-sighted persons, the course of the rays, in the opposite direction, is so precisely similar, that the same figure might serve to illustrate the advantages of the periscopic construction. For the purpose of seeing the extended page of a book with least fatigue to the eye, that form of lens will be most beneficial, which renders the rays received from each part of its surface, parallel; and this is effected by the exact counterpart to the preceding arrangement. For, in this case, the opening represents the place of the eye, receiving parallel rays from the lens in each direction, instead of transmitting them from a distance towards it.

There is, however, this difference between the two cases: that in the camera obscura, a much larger portion of the lens is required, to conspire in giving a distinct image of any one object; so that the conformation best adapted for lateral objects, would not be consistent with distinctness at the centre; and hence arises a limit to the application of the principle. On the common construction, the whole lens is so formed, as to give brilliancy and distinctness at the centre alone, without regard to lateral objects. In adopting such a deviation from the customary form, in favour of a more extended view, Dr. Wollaston says, that some diminution of the aperture is required, in order to preserve the desired distinctness at the centre. In ascertaining the most eligible form of meniscus for this purpose, he assumes sixty degrees to be the field of view required. But when so large a field is not wanted, then a lens that is less curved will be preferable; and the proportion of the radii must be varied, according to the angular extent intended to be included.

In regard to the construction of a microscope on periscopic principles, Dr. Wollaston conceives the contrivance to be equally new, and advantageous with the former. The great desideratum in employing high magnifiers is, sufficiency of light; and it is, accordingly, expedient to make the aperture of the little lens, as large as is consistent with distinct vision. But if the object to be viewed, be of such magnitude, as to appear under an angle of several degrees on each side of the centre, the requisite distinctness cannot be given to the whole surface by common lens, in consequence of the confusion occasioned by oblique incidence of the lateral rays, excepting by means of a very small aperture, and proportioned diminution of light.

In order to remedy this inconvenience, Dr. Wollaston conceived, that the perforated metal, which limits the aperture of the lens, might be placed with advantage in its centre; and accordingly he procured two plano-convex lenses, ground to the same radius, and applying their surfaces on opposite sides of the same aperture in a thin piece of metal, he produced the desired effect; having virtually a double convex lens so contrived, that the passage of oblique pencils was at right angles with its surfaces, as well as the central pencil. With a lens so constructed, the perforation, that appeared to give the most perfect distinctness, was about one-fifth of the local length in diameter; and when such an aperture is well centered, the visible field is, at least, as much as twenty degrees in diameter. It is true, that a portion of light is lost by doubling the number of surfaces; but this is more than compensated by the greater aperture, which, under these circumstances, is compatible with distinct vision. Besides the foregoing instances of the adaptation of periscopic principles, Dr. Wollaston notices their application to the camera lucida.

In drawing, by means of the camera lucida, distant objects are seen by rays twice reflected at the same time, and in the same direction, that rays are received from the paper, and pencil, by the naked eye. The two reflectors are effected in the interior of a four-sided glass prism, at two posterior surfaces inclined to each other, at an angle of 135 degrees. In the construction, formerly described, and to which allusion is here made, the two other surfaces of the prism are both plane, through which the rays are simply transmitted, at their entrance and exit. But since an eye that is adjusted for seeing the paper, and pencil, which are at a short distance, cannot see more distant objects distinctly, without the use of a concave glass, it may be assisted in that respect, by a due degree of concavity given to either, or to both, the transmitting surfaces of the prism. It is, however, to the upper surface alone, that this concavity is given; for

since the eye is then situated on the side toward the centre of curvature, it receives all the benefit, which is proposed from the periscopic principles.

Observations.—In the 3d vol p. 90, and the 6th vol. p. 60, of our work, we have made observations on the patent obtained by Dr. Wollaston in the year 1806.—To these observations we refer our readers on the nature and merits of the instruments which have drawn forth this renewed explanation before the Royal Society.

***On the vibrations of Musical Strings; with a mode of ascertaining the sound, producible by any given number of vibrations. By* Mr. JOHN SOUTHERN.—*Phil. Mag. No.* 175.**

MR. Southern, in reading on this subject, has observed a considerable difference in the number of vibrations assigned to the note C in the middle of the musical scale. Dr. Smith, in his harmonics, says, that D on the organ in Trinity College, Cambridge, made 262 vibrations in a second of time; consequently C must have made 234, or 235; and he says, it was near the Roman pitch. Dr. Young states the number at 256. In page 436 of the 36th volume of the Philosophical Magazine, 240 is given as the number, which is also given in the number for July 1812, on Dr. Crotch's authority.

Mr. Southern has examined two modern forks for this note, and found one to make 254 2-3ds, and the other 252¼ vibrations in a second: so that it appears, there is no precise number of vibrations which has been yet fixed upon, as a standard of musical pitch. It must be confessed, that the number is purely arbitrary; but if that number shall be preferred, which is more convenient than another in this kind of calculations, and at the same time approaches nearly to that, which corresponds with the present concert pitch, 252 is probably the best being divisable by all the digits, except 5 and 8. But whatever number may be fixed upon as a standard by those interested in its determination, Mr. Southern is persuaded, that the following mode of ascertaining the sound, producible by any given number of vibrations, will be found very practicable and convenient.

Take a fine steel wire, such as is used for the upper strings of a harpsicord, and while it is stretched by a weight ample enough to straighten it, measure and cut off, the length of one yard of it, and weigh it accurately in grain troy. Suspend this piece by one end from a peg, and to the other hang a weight, equal to as

many pounds avoirdupois, as the yard long of the wire weighed grains. If then the wire be made to vibrate, and the length of the vibrating part be limited to 19·573 inches, the number of vibrations in one second will be 252. If any other number of vibration be wanted, divide 4932·34 by that number, and the quotient will give the number of inches, to which the vibrating part of the wire must be limited, to produce it.

A monochord, constructed so as to have its wire nearlyvertical, and kept in tension by a weight proportioned as above, would be very applicable to this mode of ascertaining sounds.

Though Mr. Southern has mentioned a fine steel wire, as being the best for the purpose, yet he says, a good brass wire would do very well: and also catgut, if it were not for its stretching property, and the inequality of its diameter. In general, he says, it will be found convenient to rise a small ring of wire, and extend it in the well of a stair-case, so that while a weight is appendent to it, five or six yards may be measured, and then cut off and weighed; and thereby the weight of a yard may be more accurately ascertained.

Although Dr. Smith recommends a certain mode of tuning instruments having the imperfect scale, which was then, and still continues in common use, by making the major thirds and fifths beat equally quick with their bass, which may be sufficient for organs, yet he has not given a table, shewing the relative lengths of the monochord, which would give the sounds according to that mode. Mr. Southern has therefore subjoined one, in order to shew the steps of the calculation.

He says, the Doctor correctly states, that the temperament of the fifth, when the beats are to be equally quick with those of the third to the same bass, is five twenty-thirds of a comma.

Hence if, from the logarithmic ratio, 2 : 3	0·1760913
5-23ds of the log. ratio of 80 : 81 (0·0053950) be subtracted	0·0011728
There remains the log. ratio of the tempered 5th	0·1749185
This subtracted from the log. ratio of the perfect octave	0·3010300
Leaves the log. ratio of the tempered 4th	0·1261115
The difference between the log. ratios of the tempered 5th and 4th gives the log. ratio of the tone	0·0488070
Log. ratio of two tones, being the tempered 3rd major	0·0976140
Which taken from log. ratio of tempered 4th, leaves the limma-major, or greater half tone	0·0284975
Which taken from the tone, leaves the limma minor, or the less half-tone	0·0203095

These two last logarithms, successively subtracted, according to the proper order, from the logarithms 5·0000000 & 1·2916574,

and added to 2·4014005 (beginning at the bottom) will give the logarithms found in the 3rd, 4th, and 5th columns of the table; of which those in columns 6th, 7th, and 8th are respectively the natural numbers. The above logarithms are respectively those of the whole proportional string, of the whole length of the monochord string, and of the number of vibrations in a second of the latter.

On Variations in the Vibrations of Pendulums, By. Ez. Walker, *Esq.—Phil. Mag. No.* 174.

Mr. Walker's Observations on this subject, are prefaced by stating—that a Mr. Reid, of Edinburgh, in a communication to the Philosophical Journal, No. 152, had advanced "that attraction comes in for a share in those obstacles, which stand in the way of good time keeping." This position he founded upon the circumstance of having fitted up a clock to go a month, or six weeks, which he expected would keep the arc of vibration, of the pendulum, as nearly constant as possible. But, after keeping this arc perfectly above two weeks, it surprised him to find, that it began to diminish its arc, and after a time to increase again. This variation in the arc of vibration, he attributed, as above stated, "to the attraction of the weight, to the Pendulum."

This variation in the arc of vibration, Mr. Walker observes, in regard to clocks which go a month, or more, is no new discovery, as he had been acquainted with it more than thirty years. His clock, he says, goes a month or five weeks, with once winding up. But to prevent the weight from having any effect upon the Pendulum, it is wound up every fortnight.

This effect, however, is not produced by the cause, which has been supposed; for the attraction between two bodies, of a few pounds weight, is too minute to produce any sensible effect upon each other, when one of them is in motion. But the true cause will be easily understood if we reflect, that when the weight has descended as low as the bob, the space in which the pendulum then vibrates is very narrow, and consequently, it meets with greater resistance from the air, then when the weight is either above, or below, that place.

The truth of this hypothesis, Mr. Walker says, may be proved thus:—When the weight has descended as low as the centre of oscillation of the pendulum, let the clock-case door stand open; and, in less than half an hour, the pendulum will vibrate in its usual arc, if not in a greater.

The cause of this increase of the arc is evident; for the air being less confined, the pendulum meets with less resistance.

Description of the Marine Transit; by Lieut. W. Chavasse.—*Phil. Mag. No.* 176.

The Marine Transit, is intended for the same purposes at sea, as the Transit telescope on land, to afford the means of obtaining a daily correction, or adjustment, of our time keepers, whereby the longitude, or a ship's position, with respect to a particular meridian, may be ascertained, and many astronomical problems satisfactorily solved.

The principle on which the instrument is constructed, is simple, and promises, if there be no improper assumption in the premises, or mistake in the reasoning, to be efficacious. The principle, in few words, is this: that equal quantities of mercury, will pass through a given aperture in equal times, if the same height of column, reckoned from the discharging aperture, can be uniformly maintained, provided that change of temperature, have no effect on the result; or, if they have, that the quantity of the deviation may be estimated, and added, or subtracted, as the case may require.

A brief description will best explain the construction of the instrument, and the way in which it is proposed to apply to practice, the principle which has been stated.

An iron magazine is formed, containing a sufficiently abundant, but an indefinite quantity of pure mercury, and so arranged, like the steering compass, as to swing in gimbals, and that the parts attached to it may, at all times, preserve a vertical position. The regulator, the graduated tube, and the gauge, are of glass, connected by iron joints, and strengthened by brass supporters. Jointed brass rods, by which the globe swings, are also fastened to the magazine. The waste pipe, and the other tubes, are made of the elastic gum, which has been found to be impenetrable to air.

At the bottom of the magazine, there is an aperture communicating with the conduit. It is rather larger than the aperture in the regulator; and as the waste-pipe continually carries off the excess of its volume, there will be always the same depth of mercury, maintained in the regulator, to regulate the issue into the gauge.

Experience will determine the most suitable substance for mercury to run through. Trial will be made of ruby, which, it is apprehended, has neither affinity to mercury, nor will be liable to any sensible influence from temperature, or friction. By the elevation, or depression, of the hollow screws, in which the apertures are fixed, they receive their necessary adjustments, the lower one being set to fill the gauge in twenty-four hours, when the gauge, and its contents, are at the temperature of 62°.

As it may be assumed, that mercury expands uniformly throughout the small range of temperature, to which the interior of a ship, is ever exposed (supposing this range to be from 20°. to 110°.) tables for immediate use, have been calculated on this principle, from data supplied by Mr. John Dalton, of Manchester, to shew the contents, and consequently the corresponding value in time of the gauge, at every tenth of a degree of the thermometer. This minute temperature is indicated by the thermometer, which has been graduated according to Fahrenheit, and is made to resemble, as much as possible, the guage, in every circumstance which might effect its result. The scale is great, being about one quarter of an inch to a degree, which again is divided into tenths; and the bulb is kept immersed in a body of mercury, contained in the bottom of the glass-case, which is to be closed at the same time as the machine, and like it, to be well secured from the intrusion of the external atmosphere.

Much of the accuracy of the machine, will depend upon the tube which communicates with the regulator and the gauge. It is about six inches in length, of considerable thickness, and its interior capacity such, that the volume from the aperture in the regulator is nearly three minutes in filling it. On its front, are marked small segments of circles; directly on the opposite side, there are as many other segments corresponding with the same each to each. The sight of the observer must be so directed that by the reflection of the glass, two corresponding segments appear a perfect circle. When the transit of the rising column of mercury interrupts this circle, the instant shewn by a second watch, is written down by an assistant, in the same way as is usual in taking celestial altitudes or distances. This transit of the column of mercury, can be observed to the fraction of a second of time.

The cocks are both air and mercury tight, and are so connected by parallel bars, that the one cannot move independently of the other. When the ivory handle is up, the lower cock is shut, and the upper is open. By putting the handle down, the upper cock closes, and the lower opens; by which simple movement, having previously lowered the elastic tube from the hook, the mercury in the gauge discharges itself into the globe, from which it is restored to the magazine, by drawing a rope, fastened to the ring, and passing through a pulley fixed above in the deck. In this operation the globe ascends, forming a circular sweep. When it has been raised in this manner to the necessary height, the mercury runs from it into the magazine, through the pipe prepared for that purpose, and which then becomes elevated. The

globe being thus emptied, it must be let down again gradually to its place. A couple of prongs, attached to the framing at the bottom of the gauge, embrace the rods by which it is hung, and lock it securely; so, that while locked, it can have no motion independent of the machine.

The bent tube in the regulator is an air-pipe, for the purpose of maintaining a free circulation of the air in the apparatus, whether atmospheric or any other, should it be found expedient to close the machine without adopting the torriellian vacum. A similar tube is fixed in the magazine, and for the same purpose.

Mr. Chavasse gives the following directions for conducting the operation of this instrument on ship-board:—On leaving a known meridian, unhook the tube, and put down the ivory handle. While the mercury is running out of the gauge into the globe, be careful to compare, with the time of the day, the instants of the transit rising column of mercury over the segments of the tube, as already described. Having recorded these observations, and the gauge being perfectly empty, put up the ivory handle, raise the globe, and let the mercury that is in it run into the magazine.

On the morrow, when the gauge is full, and the mercury has appeared rising above the cock, put down the handle to cut off the communication, and unhook the elastic tube, as before. Carefully observe again the transit of the column of mercury over the segments, &c. and together with these observations, write down the height of the large thermometer. The gauge being empty, put up the ivory handle, and restore the mercury in the globe to the magazine. By reference to the tables, shewing the capacity of the gauge at every tenth of a degree, find against the temperature, which is noted down, the time that has elapsed since the last operation; which, compared to the ship's time, gives the longitude sought, or the ship's departure from the meridian of the preceding day. Record this time in your book of reckoning, and proceed from day to day in the same manner. If the operator should be too late, and find the graduated tube filled, he will have lost the opportunity of observing his time for that day. The chamber which the aperture would be about an hour and a-half in filling, will secure the instrument from "going down," in the same sense in which that expression is issued in regard to a clock, or watch. In such a case, it would be only requisite, to unhook the tube, to put down the ivory handle, and to register the time found in the tables to correspond with the height of the large thermometer. Then when the gauge is empty, put in the ivory handle, and go through the usual process of restoring the mercury in the globe to the magazine.

This omission (it is to be remarked) occasions no error, the next day's observation, only, becoming a reckoning for two days.

Observations—We feel the inadequacy, in many cases, of our description of valuable instruments, without the aid of the plates, by which the inventors illustrate them. In such cases, we have no course to pursue, but to refer our readers to the plates in the work in which they first appeared; and in the instance before us, we must content ourselves with stating, generally, that the instrument of Mr. Chavasse appears to be calculated to produce the end for which it was designed, and to rank with other important improvements of a similar nature.

On a new Economical Lamp; by Mr. KERBY.—*Phil. Mag. No.* 176.

MR. Kerby prefaces his communication by alluding to a figure, and a long account of an economical lamp, mentioned in a number of the Philosophical Journal.

Like Argand's lamp, he says, it has an air-tube through the centre of it, and the flame is surrounded by a glass chimney. But the chimney is very short, and the flame arises from eight small wicks that are placed at equal distances from one another, in a circle round the air tube. The small tubes, which contain the wicks, are not large enough in diameter to receive more than four threads of cotton. The inventor compared his lamp with an Argand's lamp, by a given quantity of water with each, and found them equal in power, while his own consumed not more than half so much oil as the other!—Mr. Kerby states, that he has had one of these new lamps constructed, and has made the following experiments with it.

EXPERIMENT 1.—The two shadows of a cylinder of wood were equally strong when an Argand lamp was fourteen feet, and the new lamp only seven feet four inches, distant from the white plane, on which the shadows were exhibited.

EXPERIMENT 2.—A dish of water, having a thermometer in it, was placed an inch above the glass chimney of the Argand lamp. In 73″ the temperature of the water was elevated from 55″ to 75″. The dish, containing the same quantity of water at 55″, was placed an inch above the chimney of the new lamp, and the temperature was not raised to 75″ in less than 165″. The chimney of the new lamp was three inches long, and that

of the Argand lamp four inches and a-half. The new lamp seemed to act as powerfully without the glass as with it.

EXPERIMENT 3.—Imagining that the wicks of the new lamp might have a better effect if ranged in a smaller circle, they were accordingly altered, and again used, but this time with a glass chimney only one inch high; for a longer chimney extinguished the lights. The two shadows were equal when this lamp was eight feet one inch distant, and Argand's lamp fourteen feet.

EXPERIMENT 4.—The Argand lamp raised the temperature of a given quantity of water 10° of Fahrenheit in 58″ of time. The other lamp produced an equal effect in 78″, the chimnies, in both cases, being placed at the same distance below the dish of water. But when the flame of the new lamp was placed, as far below the water to be heated, as the flame of the other had been, the new lamp had not an equal effect in less than 188″.

EXPERIMENT 5.—The two lamps being weighed, it was found that the oil consumed by them in the same length of time was nearly as 10 to 13, the Argand lamp consuming the most.

Observations. If Mr. Kerby's experiments are correct, and faithful, the description given by the inventor of this new and economical lamp, must be proportionably of an opposite character. As we are not in possession of the instrument, for the purpose of bringing the fidelity of these contending parties to the test, we must leave the contest as we find it.

On the Barometer; by RICHARD WALKER, *Esq.—Phil. Mag. No.* 172.

MR. WALKER'S present observations on the Barometer, form a continuation of remarks, which, through the same medium of communication, he addressed to philosophical readers, in the conclusion of the year 1810.

He prefaces the ideas, which he now offers, by stating, that he has judged it expedient, to descend occasionally to particulars, which, to many, must be totally unnecessary, but which to some persons, who may not have paid much attention to the subject, he hopes may not prove altogether unacceptable. He then proceeds to make the following observations.

The Barometer, when *stationary*, and having a *concave-surface* at the top, is almost an infallible indication of *rain*, at the place of observation, or in its vicinity, especially if the Barometer be at, or below, *changeable*. The Barometer, when stationary, and with a *convex surface* of the mercury at the

top, is a strong indication of *fair weather*, at the place of observation, or its vicinity; especially, if the Barometer be at, or above, *changeable*. In the first instance, Mr. Walker accounts for the circumstance, by the natural spring, or elasticity of the air being suspended, or diminished (the density of the atmosphere remaining the same) by the intervention of vapour, collecting into a mass; and, in the latter instance, to the dispersion of the interposed vapour, by which the natural elasticity of the air, is restored.

For the same reason it is, he presumes, that during a steady fall of rain, the Barometer is commonly *stationary*, with a *concave surface* at the top. And as soon as the weather begins to clear up, the top of the mercury in the Barometer assumes a *convex surface*.

The quick ascent of smoke, vapour, &c. into the atmosphere, indicates fair weather; and the slow ascent, and particularly the descent of them, indicates rain. The former, in consequence of an influx of denser, or heavier air, into the lower stratum of the atmosphere, commonly proceeding from the north and east points. And, the latter, in consequence of an influx of rarer, or lighter air, into the lower stratum of the atmosphere, proceeding commonly from the south and west points.

Upon the whole, there is more wet weather, while the Barometer is above *changeable*, than there is dry weather, while the Barometer is below *changeable*. Hence it follows, cæteris paribus, that the former state of the Barometer, is not so strong an indication of fair weather, as the latter is of rainy weather.

The rising of the Barometer, especially if it be progressive, whilst the wind is in the south, or south west points, indicates a change of the wind to the north or east points. And, conversely, the sinking of the Barometer, whilst the wind is in the opposite points, indicates a change to the south, or west points.

In the spring, and as summer advances, rain brings successively warmer weather: and in autumn, and as winter approaches, rain brings successively colder weather. Hence, successive showers gradually change spring into summer, and autumn into winter.

The reason, of this, according to Mr. Walker's conceptions, appears to be, that, during fair weather alone, the true character of each season, in regard to temperature, is exhibited. Whereas, it is, in some degree obscured, or suspended, during cloudy weather.

The mercury in the Barometer is usually fixed, at whatever height it may happen to be, with a concave surface, during

settled rain; and fixed, with a convex surface, during settled fair weather. In order to make accurate observations upon the Barometer, it is necessary to use a magnifier, which should be fixed to the moveable index.

Fogs in the *morning*, are more visible over land, than over water, because the greater coldness of the land, condenses the vapour most; but in the *evening*, over the water, because water is then colder than the surface of the land. The *mean height* of the clouds above the earth's surface is about three quarters of a mile; the *greatest height*, a little more than a mile; and the *least height*, about three furlongs, and sometimes, in thunder storms, even less.

In order to make the most accurate observations on the state of the weather, and to predict the various changes that are about to take place in it, the observer should be provided with a barometer, thermometer, and hygrometer, each of the best construction. And, in order at all times, to be able to notice the changes in the direction of the wind, which are taking place, and which is absolutely necessary, it would be expedient to construct a wind vane in such a manner, as to exhibit the direction of the wind within the room, which is appropriated to meteorological observations.

The *rising* of the barometer, is a more certain indication of fair weather, than its *sinking* is of rainy weather; because it sinks for wind, as well as rain. If, therefore, while the barometer is sinking, the atmosphere still remains clear, wind may be expected.

In winter, spring, and autumn, a sudden falling of the mercury presages, high winds, and storms; but in the summer, heavy showers, and sometimes thunder.

The principal changes in the atmosphere take place about the time of the vernal equinox.

Rain, or snow, may come during a north, and easterly wind, whilst the barometer stands higher than when the wind is in the south, or west points; because, in the former instance, the clouds come from a denser, to a rarer medium, and in the latter, from a rarer into a denser medium. The *maximum* and *minimum* heights of the barometer in this, and every other country are limited by nature, in the following manner. When the atmosphere is charged with as much water in a state of *chemical combination*, under the most favourable circumstances, for absorbing it, as it can sustain, it is then *heaviest*, and the barometer is at its *maximum*;—And when the air is most free from, or contains the least quantity of water, in a state of chemical combination, other circumstances concurring, the atmosphere is then *lightest*, and the barometer is at its *minimum* of height.

Hence, cæteris paribus, the absorption of water, by air, renders the atmosphere heavier, and its parting with it, renders it *lighter.*

The following is a curious, and satisfactory circumstance, to prove the power of air, in absorbing water or vapour. If a small cloud, or fragment of a cloud, be observed, in a loose or rare state, insulated from others, in a clear part of the atmosphere, especially when the air is warm and calm, it will be found to melt and dissolve gradually in the atmosphere, and at length to vanish entirely.

During the experience of many years of observation on the barometer, it may be found that, in England, its *greatest height*, will not exceed one inch and a quarter *above changeable*; nor, its *least height*, the same distance *below changeable.*

The variations in the barometer, are *greatest* towards the poles; *less*, in temperate latitudes; and *least*, between the tropics.

The moisture on the ground, and in other situations, freezes, when the atmosphere is warmer than 32°. which is the freezing point, in consequence of the cold, produced by evaporation. Under the most favourable circumstances, namely, a *dry air*, and a *brisk wind*; this may happen, when the air is eight, or ten degrees above the freezing point. The *rise* or *fall* of one-tenth of an inch in the barometer, is usually accompanied, or followed, by a very perceptible change in the atmosphere.

Rain happens, among other causes before mentioned, in consequence of the subtraction of the electric fluid, which, when the air abounds with vapour, is easily conducted to the earth. Hence arises the velocity of rain in thunder showers.

In this climate, the *hottest* time of the day is about three in the afternoon, in consequence of the continued influence of the sun, whilst near its *greatest height* from the horizon; and the *coldest* is a short time before *sun-rise*, namely, that time, at which our part of the earth has been longest without the influence of the sun.

The *hottest* month in this country is July; and the *coldest* month is January;—the former, in consequence of the continued strongest influence of the sun, while near its greatest elevation from the horizon; and the latter, in consequence of the continued weakest influence of the sun, whilst nearest its least elevation from the horizon. The *driest* months are July and August; and the *wettest* months are October and November; the former, in consequence of the small quantity of water which has been raised into the atmosphere previously, and the powerful influence of the sun, during these months in dissipating the vapours, which

are raised; and the latter, in consequence of the *inverse effects* of these two causes.

The greater or less avidity, with which the mercury appears to rise or sink, as exhibited by the greater or less *convexity* or *concavity* of the mercury, at the time of observation, the stronger or weaker, will be the indication in each instance.

The surface of the mercury in a barometer is best seen, when the tube, at the part to be observed, is exposed to the light behind, that is, constructed without an opaque substance at the back of it.

The *convex* or *concave* surface of the mercury arises, of course, from the adhesion of the mercury to the tube, in rising or sinking. At each observation of the barometer, therefore, after noticing the variation in height, the index should be first accurately placed, and the Barometer smartly rapped with the fingers, in order to reduce the mercury to a level, and then the index should again be accurately adjusted. The principle of a barometer is so perfectly uniform in its effect, that although from want of precision in their own construction, any two of them may not, under similar circumstances, respecting the state of the atmosphere, and the elevation in which they are placed, stand precisely at the same height, yet all agree in this—they will rise or sink at the same time.

The ordinary upright barometer, is the only one in use among scientific persons, of which there are two kinds, namely, the cistern or bason barometer, and the syphon barometer. The former of these requires a floating guage, with an adjusting screw, in order to shew the precise length or height of the column of mercury in the tube, which is essential in accurate observations, and particularly in the measurement of altitudes. But barometers intended for the purpose of measuring altitudes, are filled up in a peculiar manner, agreeably to that intention. The attractive power of the sun upon the earth's surface, is to that of the moon, as two to five.

In regard to the direction of the wind, it is tolerably uniform within the tropics, being more immediately under the influence of the two principal causes, which produce currents of air; and 1st. of the sun, which in its course, by heating the places it passes over, causes a considerable rarefaction of the air in them, and which is constantly followed by a current of air, to restore the equilibrium; and 2d. the current of wind, which is produced by the attractive influence of the sun and moon on the atmosphere, as the different places pass under them.

Near the poles, the wind is probably more uniform, than it is in the middle and temperate climates, the lower portions of the air being constantly inclined towards the equator, in consequence of

the increasing heat in that direction, and the upper portions being renewed, from the more elevated regions of the inter-tropical currents.

In the middle or temperate climates, besides the operation of causes unknown to us, the direction of the wind becomes more complicated, in consequence of its situation between the two former, being influenced by each of them, separately or conjointly. Mr. Walker observes, that there appears to be a kind of habit in the weather, as in other cases. Thus, towards the close of the series of *dry weather*, several efforts are apparently made towards a series of *rainy weather*, before it actually sets in inversely.

The atmosphere becoming *drier*, as indicated by the hygrometer, exhibits a disposition for *fair weather* and vice virsâ.

A cold, dry, and serene state of the atmosphere is most favourable for barometrical measurements. The limit, or boundary of the atmosphere terminates where the expansive force or power of the air *upwards*, or from the earth's surface, is completely overcome by the force of gravitation *downwards*, or towards the earth's surface, which is estimated at forty-four, or forty-five miles.

A pint measure of air when the barometer is 29½, in England, weighs eight grains, or a gallon, sixty-four grains; but near the poles somewhat more, and at the Equator somewhat less. This variation in the weight of the air, in the different parts of the world, is ascribed to a difference in the height of the atmosphere, by which it happens, that the air near the surface of the earth at different places, differs in density, the pressure or weight of the incumbent atmosphere being the same. The atmosphere is presumed to extend highest at the Equator, and to be *lowest* at the Poles, in consequence of a greater degree of *centrifugal* force and *heat* at the Equator.

The barometer has been unquestionably observed in England, to rise above thirty-one, and to sink below twenty-eight, namely, to exceed these limits each way, by the tenth of an inch.

The lowest point, at which Mr. Walker ever observed the barometer, he states to be, 28½ inches, and this was on the 9th of November, 1810, a day remarkable for high wind, and a torrent of rain.

The ordinary rage, or variation, in the barometer, differs according to the latitude of the place. Thus, at the Equator, except at the hurricane season, it is scarcely any thing; and at the Poles it is probably not less than four inches, varying in an increasing ratio, from the Equator to each pole. The barometer at Peru, under the Equator, varies ordinarily to the extent of two or three tenths of an inch; but at Petersburgh, to the extent of three inches.

The column of mercury, as most persons know, is sustained by the counter-pressure of a column of air, of the same base, extending to the top of the atmosphere; which, when at its mean state of gravity, that is, when the barometer is at 29½ inches, presses on the base of the mercury, with a weight which is equal to, or at fifteen pounds, upon each square inch of surface.

In a comparison of barometers, placed in different situations, with respect to elevation, allowance must be made, at a mean rate, of one hundredth of an inch on the barometer for each complement of nine feet measure in height, that quantity being added to the higher barometer, or subtracted from the lower one, in order to make the comparison equal. The difference in the height of two barometers, equally well constructed, one being in the ground floor, and the other in the attic, will, of course, amount to several hundredths of an inch.

It has been confidently asserted by respectable authors, that the barometer is affected by the *atmospherical tides*. It does not appear however, that any observations have actually proved the fact.

Observations.—Mr. Walker in his former and present observations on the barometer, has offered a mass of information, which cannot fail to be interesting and useful to those meteorologists, to whom the principles of philosophy have not been familiar. Persons of this description may build with confidence on the general rules which he lays down. It may not, however, be improper to add to his remarks, that the barometer is as just a measure of the weight or compression of the atmosphere, as the thermometer is of its heat or cold; and, though it is more subject to variation in the temperate regions of the earth, than within the tropics, and though there may be greater falls of rain in the latter than in the former, and which may of course render the indications of the barometer less certain, yet it is an instrument necessarily connected with motions in the atmosphere, though not equally connected with all its motions. It is chiefly affected by those motions, which produce accumulations and abstractions of this fluid, in places or regions of sufficient extent to affect the pressure of the atmosphere upon the surface of the earth. But as every commotion in the atmosphere may, under proper conditions, be a cause of rain; and as the want of commotion in the atmosphere, is naturally a cause of fair weather, this instrument may be made of great importance for the purpose of making observations respecting the weather, although not in the certain and more simple manner in which it has been, with the increase of science, so successfully applied to the measuring of heights.

On the luminous appearance of Sea Water. By KNIGHT SPENCER, *Esq.—Phil. Mag. No.* 173.

MR. Spencer states, that on the 8th of August, 1812, in the evening, being at Blackpool, on the Western coast, and observing the sea to be at all times very luminous, he went to the Beach, in order to view it more clearly. And accidentally stamping on a flat part over which the tide had flowed, but from which it had receded a few feet, being about half an hour after the high water, he was surprised by the appearance of some hundreds of sparks of light, which surrounded his foot in every direction, to the distance of about fifteen inches, the largest being the nearest. The light however, was only instantaneous. Struck with this novelty of the appearance, he stamped a second time on the spot, and produced a very few sparks. He afterwards stamped repeatedly on the same spot, but without producing any. He then sought for a similar flat spot on the beach, and by stamping upon it produced the same appearances, as in the first case. He then tried the sloping part of the beach, but without success. On trying again, on the flat parts, the same appearance invariably occured.

Unwilling that so singular a fact should rest on his own representation, Mr. Spencer requested a friend to accompany him to the beach, when the experiment was repeated several times, with the same success.

It seems, says Mr. Spencer, that the tide, at high water, had deposited something in these flat places; and, that the friction of the shingles against each other, produced by the stamping, was the cause of this matter emitting the luminous appearances. The tide had effectually left the beach, and there was not the least appearance of water in the places acted upon.

Observations.—By a variety of ingenious experiments, the celebrated Canton established the principle, that the luminous appearance of the sea, is principally owing to the putrified substance, which is so intimately mixed with its waves; and that its exhibition of this appearance is greater, or less, in proportion to the presence of the putrescent matter, and the agitation of its surface. Is it not probable, that the particular appearance, which forms the subject of Mr. Spencer's communication, may be ascribed to the same cause, that is the substance, or sediment, left, by the subsiding of the waters, on the vegetable matter of the coast; and which in consequence of the friction, occasioned

by the pressure, or stamping of the foot, becomes capable of producing the same effect?—Our readers may be gratified by examining the different opinions connected with this subject, under the term, "Sea," in Chambers's Dictionary.

On draining Land by the Steam Engine; shewing the number of acres that may be drained by each of six different sized Engines; with prime cost, and annual outgoings. By Mr. WILLIAM WALKER. *Repertory of Arts, No.* 125.

MR. Walker commences his observations on this important subject, by remarking, that considerable tracts of low grounds and swamps lie a great distance from the nearest out-fall; and, at the same time, that the land which lies between the low grounds, and the out-fall, is frequently many feet higher. In many instances, therefore, it becomes necessary to cut drains sixteen, eighteen, or even twenty feet deep, and for many miles in length, which occasions such an enormous expense, that the cost of draining exceeds the value of the land itself.

In consequence of the above considerations, and with the view of superseding the usual plan of destroying land by deep drains, and wasting enormous sums of money, he has been induced to offer his observations on draining land by the steam engine, and to prove with what ease almost all the low lands in the kingdom might be drained, and at an expense comparatively but trifling.

Mr. Walker assumes, that the steam engine has been but little applied to the draining of land, although it is particularly applicable to this and all similar purposes. It is his object, therefore, to give such a statement of the expenses attending the erection of steam engines for this special purpose; and, also the annual expenditure connected with them, that the land-owner may perceive the great advantage to be derived by employing them in draining of his land. In order to secure this object, and to illustrate his views, his communication presents four distinct tables.

TABLE the first, shews the number of cubit feet of water, which each engine will pump in twenty-four hours, under the respective heights; also, the quantity of coals consumed by each engine, in twenty-four hours.

TABLE the second, exhibits a number of acres of land, which may be drained by each engine, allowing it to work only ninety days during the three hundred and sixty-five.

TABLE the third, shews the cost, and annual out goings of six different sized engines, viz. Of three-horse power.—Four-horse, do.—Six-horse, do.—Eight-horse, do.—Ten-horse, do.—and twelve horse, do.

TABLE the fourth, shews the diameter of the cylinder, where the bucket works, in inches and parts, under the respective heights for each engine, with the motion of the engine.

If, as an example under table the first, it be required to know the number of cubic feet of water which an engine of four-horse power will raise sixteen feet high, in twenty-four hours, will be seen, that the number is 330,000. And in the same way, the proper requisites are formed, for any other engine, within the limits of the table.

The table has been calculated upon established principles, founded on experiments made by Mr. Watt, upon engines, which he made more than thirty years ago; and, therefore the powers allotted to them cannot be too great, as many improvements have, since that period, been made upon them.

In order to ascertain the quantity of land, which one of these engines is capable of draining, Mr. Walker takes into consideration the quantity of rain that falls in the course of the year; and also, the quantity of water evaporated in that time.

He takes the quantity of rain which fell in twelve different places in the kingdom in the year 1808, the average of which, he finds to be 29. 41 inches; and that the evaporation in May, June, July, and August, at Liverpool, on a medium of four years, was found to be 18. 18 inches; so that in the above four months, the evaporation was three times greater than in November, December, January, and February, for the evaporation in these four months was only 6. 06 inches. Mr. Walker assumes, that the evaporation in March, April, September, and October, is equal to the quantity of rain which falls in those months. Whence it will follow, he says, that since the evaporation in the four summer months is equal to double the quantity of rain that falls in them, and as the evaporation in the four winter months, is not equal to the quantity of rain that falls in them, by four inches, or nearly so; and, also, since the evaporations and rain are equal to each other in March, April, September and October, it will follow, that the quantity of water, which will require to be drained from the land, will be equal only to four inches deep, in the course of the year. From these data the second table has been calculated.

The kind of land, which is intended to be drained by the steam engine, includes those low grounds, where an outfall cannot easily be procured, and where the surface of the land is lower than the surface of the water in the drain, that might be made to carry it off. In this case, the land must be embanked,

so that no water may come upon it but what may come from the clouds.

The second table, as already represented, shews the number of acres, which each engine is capable of draining, under the respective heights, which may be found necessary for the water to be raised, in order to drain the land completely, the engine working only ninety days, during the three hundred and sixty-five. It is not here to be understood, that the engine is to work ninety successive days, and then to give over. It is intended to convey the idea, that the engine shall work when it is wanted, that is, whenever the water has so accumulated, that it is necessary to drain the land; and by taking the number of days, in which the engine is employed at different times in the course of the year, and adding them together, this sum shall not exceed ninety days.

If, therefore, the quantity of land be known, and the height to which the water is to be raised be known also, then the table will shew the power of the engine necessary to perform the work, that may be required. If, for example, a land-owner has 3060 acres, which he wishes to drain, the table will shew that, in order to raise the water eight feet, an engine of a three-horse power will produce the effect desired. Again, if a gentleman has 6000 acres to drain, and it is required to raise the water sixteen feet, the table will shew, that an engine, of twelve-horse power, will be adequate to the drainage of 6120 acres. In like manner other powers, and other requisites, are exhibited in the table.

If it be required to know the quantity of water which may be pumped from the land in the ninety days above specified, by consulting the first table it will be seen, that under the figure sixteen, combined with the twelve horse, the daily product being 990,000 the annual amount for the ninety specified days, will be 89,100,000 cubic feet.

Having exhibited the power and performance of the different engines, Mr. Walker proceeds to consider the first cost, and annual out-goings connected with them.

The third table is intended to convey this information. In the first column is the power of the engine, in the second, the price, in the third, the weekly expenses, in the fourth, the annual repairs, in the fifth, the quantity of coals for ninety days, in the sixth, the amount of the coals at 30s. per ton, in the seventh, the salary for the engine man, and in the eighth are contained the total annual out-goings.

The price and weekly expenses, were given to Mr. Walker, by an engine maker. He has allowed five per cent. on the cost of the engine, for annual repairs, which is above the necessary

allowance. The quantity of coals, is what is consumed by one of Mr. Watt's engines. He has allowed twenty-six guineas, for a man to overlook the engine, which is conceived to be sufficient, as he will be at liberty three-fourths of his time, or nearly so, to attend to any other business. But it is necessary, that he should have a house near the engine. The price in the table, is what the maker would charge at his own works; and as every thing belonging to the engine is sent with it, the building and some wood for a frame, for the fly-wheel, the carriage, and putting up, would be an additional expense.

If a land-owner possesses 4089 acres, which he is desirous to drain, and that it is required to raise the water six feet high, by examining the second table, and under the figure six, he will find that an engine of three-horse power, will perform the work, and the third table will shew him, that the annual out-goings of that engine will amount to 96l. 19s. 6d.; now, if a tax of sixpense an acre were levied, it would amount to 102l. 4s. 6d.; Again, if the water is to be raised twelve feet, then the tax must be 1s. per acre, as it would require an engine of double power. Once more, if a large common, of 16,000 acres, requires draining, and the water to be raised six feet, the second table, under the figure six, will exhibit 16,356, or 356 acres more. Thus, a twelve-horse power, is the proper sized engine for this purpose. The annual out-goings of this engine, amount to 289l. 7s. and a levy of 5d. an acre, amount to 333l. 6s. 8d. which is an overplus of 43l. 19s. 8d. at the trifling sum of 5d. per annum. By the second and third tables, a land owner may easily gain a knowledge of the expense of an engine, to drain any quantity of land, so as to raise the water to any given height; and also, of the annual out-goings, to which the draining of any certain quantity of land, may subject him.

By this grand machine, every swamp in the kingdom may be drained, and many thousand acres of rich land, may be thrown into cultivation, which now lie under water, to the great loss of the public. But Mr. Walker trusts, when noblemen or great land owners are convinced, that their low grounds and swamps, may be drained for so small an expense as 5d. or 6d. per acre, annually, that they will not hesitate in adopting the plan. The first step, he says, which is necessary, is to imbank the land with a mound, sufficiently high, to prevent any upland, or flood waters, from over-flowing it. The earth, which is dug to make the bank in the inside, will form a good drain for conveying the water to the engine. Also a few other drains, well laid out, will be wanted; and when the engine is added, the chief expense will be ended: and thus, land may be brought into cultivation, which was previously useless, and may probably

be let at three or four pounds per acre, which is known to be the case in the Lincolnshire fens.

Mr. Walker presents the following observations, respecting the draining of Whittlesea Mere. Being ignorant of its exact extent, he supposes it to contain 4000 acres, and that its average depth of water is three feet; and, that in order to clear the land, the water must be raised ten feet, that is, four feet from the surface of the water, to the top of the drain bank, and six feet depth of water. Now, as the Mere contains 4000 acres, and each acre, 43,560 square feet, then $4000 \times 43560 \times 3 = 522720000$ will be the content of the water in cubic feet. The first table, shews that a twelve-horse power, will raise 1584000 feet in twenty-four hours, ten feet high, then $522720000 \div 1584000 = 330$, which is the number of days, which the engine will take in clearing the mere of the water; and when the water is once cleared, an engine of half the power would keep it clear afterwards. Surely, says Mr. Walker, this must strike every person, whose mind is open to conviction. But what is the draining of this Mere compared with what the states of Holland were about to do before the commencement of the last war! they were actually in treaty with Messrs. Boulton and Watt, for the draining of Haerlem Mere, an undertaking of fifty times the extent of Whittlesea Mere.

In order to save the engineer trouble, and also, to convey information to the engine maker, Mr. Walker has calculated his fourth table, which shews the diameter of the pump, where the piston works, in inches and parts, under the respective heights for each engine, together with the motion. Thus, an engine of six-horse power, made equally perfect, with those constructed by Messrs. Boulton and Watt, the length of the stroke being four feet, and making twenty-six single strokes in a minute, as in the table, (which will be double when the engine is at work), if we look along the same line, from the six-horse power, in each column, we shall have the diameter of the pump, for the different heights. Thus, if it be required to raise the water ten feet, the cylinder must be 22.11 inches, and so of all the rest, throughout the table. Care must be taken, that the height of the water, to be raised, be measured from the bottom of the drain, or nearly so; for, if it be taken from the surface, and a pump adapted accordingly, it will then be found, when the water has lowered a foot and a half, or two feet, that the engine will be so overloaded, that it cannot work, on account of the increased weight of water which it will have to lift, for the pressure of water, is as its perpendicular height. If it be six feet from the water in the drain, and the drain be two feet deep, the diameter of an eight feet cylinder must be chosen, and then

the engine will be always master of its work, but not so, if the diameter of a six feet pump be used.

Mr. Walker concludes his observations on the superior efficacy of the steam engine, to other machines in draining land, by the following remarks—If a six-horse power will drain 8,178 acres, and raise the water six feet high, the cost of erection, not being more than 700l. or thereabouts, and the annual outgoings not exceeding 166l. 16s. it is obvious, that it will accomplish more than ten wind engines can perform; for the latter will raise the water little more than three feet. Away, then, with such trifling things!

Observations.—Every plan which promises the multiplication of vegetable productions in a populous state, is worthy of the attention of government, and of the holders of large tracts of uncultivated land. This country presents a great extent of surface, which lies in a state comparatively useless, in consequence of the want of some cheap and effective mode of draining. If therefore, Mr. Walker's plan of calling in the aid of that powerful instrument, the steam engine, for this purpose, can be rendered effective, and at the slight expense stated in his calculations, he has rendered a service to the community of the most important kind. The tables which he has furnished for the illustration of his calculations, are interesting. To these we refer our readers for the formation of their opinion on the subject, cordially hoping, that if the plan is fraught with the certainty of those advantages which are stated, it may meet with immediate and universal adoption.

On the construction and effects of the Pneumatic Tinder Box. By Le Bouvier Desmortiers.—*Phil. Mag. No.* 176.

Spunk, which is the substance used in the Pneumatic Tinder Box, is prepared from agaric, which is first boiled in water, beaten well when dry, steeped in a strong solution of saltpetre, and dried in an oven. The inflammation of this substance, by the compression of air alone, is a phenomenon which chance has communicated to us.

The first construction of the Pneumatic Tinder Box was, in the opinion of M. Desmortier faulty, the piston being commonly 18 or 20 lines long. This was said to be necessary, that the air might not escape when the piston was in action; for if there were any point not accurately fitted to the tube, the air escapes, and the spunk does not kindle.

The goodness of the instrument does not depend on the length of the piston, but on the accuracy with which it fills the bore

of the tube. With a tube well bored, and a piston of six lines, the air will no more pass than with a piston of twenty; accordingly for a tube of six inches, he reduced the piston to six lines, which adds an inch to the column of air, and diminishes the friction two-thirds, so that the effect of the tinder box is more certain, and it is also more easily used. With a little dexterity the spunk may be kindled, by holding the tube in one hand, and pushing the piston with the other, without being obliged to rest it on the table, or any other solid body. M. Demortiers recommends the use of short pistons, in the syringes of air-guns, of fountains acting by compressed air, of the apparatus for artificial mineral waters, of fire engines, and even of air pumps. Shortening the piston is an advantage to the pump, in regard to time, as well as labour.

It is essential also, that the instrument should not leak where the spunk is placed, because then the transient action of inflammation takes place, and a slight emission of air would prevent the effect. But this effect is produced, though the piston does suffer the air in the tube to pass it. To satisfy himself of this, M. Desmortiers made the following experiment.

In the length of the piston, he made a groove, a quarter of a line broad. The spunk took fire as before. Three other grooves were added successively, one opposite to the other, so as to divide the piston into equal parts, and still the spunk took fire. When the grooved piston is moved backward and forward in the tube, the air may be heard entering or issuing out; and the friction is so slight, that the effect of the instrument is easily obtained, by pushing it with the hand. This kind of piston would be preferable to those that fit accurately, if a solid substance were employed, hard enough to resist the continued operation of the air in passing through the grooves. The grooves in leather pistons soon alter their shape, and spread in such a manner, as to allow the air to pass it in too large a quantity.

The piston with four grooves acting very well, M. Desmortiers made one with a single groove, of dimensions equal to the other four, and what he foresaw, actually took place: there was no inflammation. The following he states as the reasons of this difference.

The extremity of the grooved piston, exhibits the area of a circle, the periphery of which touches the interior edge of the grooves. The column of air contained in the tube, rests almost wholly on this base. Only the parts corresponding to the grooves, that are continued through the length of the piston, communicate with the external air. When the piston is pushed with sufficient velocity to kindle the spunk, the parts of a column, corresponding to the grooves, rush into them with equal velocity; but the friction they experience, in passing through such narrow tubes, oc-

casions a resistance to their passage, a kind of choaking, which suffers only a part to escape, while the column resting on the area of the piston, is pushed entirely towards the extremity of the tube, where the spunk, which is to be kindled, lies.

In the piston, with a single broad groove, the area of the circle, on which the column of air rests, is much smaller; consequently the column itself is less. The resistance the air experiences in passing through the groove, is next to nothing; for no noise is heard in moving the piston backward and forward: and as air expands in all directions, when the piston is moved, the column resting on the area of the circle, resting at the same time laterally on that which answers to the groove, it recedes from all the points of contact, and flows entirely through the channel it finds open. It is so true, that it wholly flows out, that the piston, when it touches the extremity of the tube, remains there; while with other pistons, a sufficient quantity of air is retained to occasion a spring, and repel them.

M. Desmortiers thinks it proper to advert to the quality of the spunk. He says, the driest, softest, and least impregnated with nitre, should be chosen. In spunk of the best quality, a piece will not always be found equally good throughout. Some contains a great deal of nitre, and is kindled with difficulty. This may be known, by the cold taste it leaves on the tongue; or by kindling it: for when it has taken fire, the nitre melts, and some times throws out sparks, that may be dangerous when they spirt out of the instrument, particularly if made with a cock. As it is usual to blow on the spunk, to try whether it be kindled, a spark may be thrown from it into the eye.

Those persons who imagine that electricity kindles the spunk, consider these sparks as an incontrovertable proof of their opinion. M. Desmortiers thinks they are mistaken; yet he does not conceal a fact, which was communicated to him by M. Veau Delaunay, which seems to confirm this opinion. Out of twelve times, when he operated with the instruments, without any spunk in it, he saw sparks emitted in it three times.

M. Desmortiers then continues his observations on the construction of pistons.

If we could find, says he, an elastic substance sufficiently compact to be turned in a lathe, we should have perfect pistons, that would spring and adapt themselves to the inequalities of the tube, without suffering a bubble of air to escape. He made some with caoutchoue, softened before the fire, in order to give it a degree of elasticity more obedient to the inequalities of the tube. But on attempting to turn it in a lathe, it bent under the tool. Even the edge of a razor would not take hold of it; so that the piston remained uneven, and almost ragged, and

yielded like soft wax under the fingers. In this imperfect state, it so far prevents the air from escaping, that a column of three inches is sufficient to kindle the spunk. But after a few strokes of the piston, the heat dilates it to such a degree, that it cannot be moved without considerable force. If a drop of oil be put on it, it moves easily; but this soon spoils the instrument: for the oil dissolves the caoutchoue, and forms a varnish, which as the piston grows hot, causes it to adhere more strongly to the sides of the tube.

Might not these inconveniences be avoided, by arming the piston rod with caoutchoue, and covering it with leather? If this process succeeded, it might be applied, with advantage to all sorts of pumps.

To attain, if possible, a knowledge of the principle of inflammation in the pneumatic tinder box, four things are to be considered, viz.—The materials of the tube, the matter contained in the tube, the materials of the piston, and the friction. Among the materials of the piston, he includes the grease, with which it is coated, to make it move more easily, and render it more fit to intercept the passage of the air.

In examining the question, whether the spunk be kindled by electricity, M. Desmortiers considers,

That no part of the instrument is insulated; and that insulation is a necessary condition for producing sensible electricity with any of the machines we know.

The friction of the piston, which is a greasy body, against a metallic substance, is not calculated to produce electricity.

Experience demonstrates, that, unless during storms, the atmosphere seldom exhibits any signs of electricity, at the height we breathe it; and that we must search for them with instruments, in a more elevated region, or when electric clouds, are passing over our heads. How then shall we estimate the infinitely small quantity of electric matter, in a cubic inch of air, or even less, which the instrument contains?

It is not without great difficulty, that we can kindle spunk with strong electric sparks. M. Desmortiers discharged a large jar on spunk, strewed with powdered resin, and it remained unkindled, though the resin caught fire, and burned entirely away.

M. Desmortiers pursues his train of reasoning in the following manner.—As long as the instrument was made with metallic substances only, he was obliged to confine himself to the exterior marks of inflammation alone, without being able to assign the true cause, or at least furnish proofs of it. For to guess, is not sufficient in natural philosophy. We must demonstrate, in order to give to facts, that degree of certainty, which is appro-

priate to science; and this cannot be done in this case, without observing what passes, at the very point of inflammation. The means are very simple, nothing is necessary but to substitute a glass for a metal tube. M. Desmortiers procured three, which he filled up. The first, eight inches long, by eight lines in diameter, did not kindle the spunk. The second, nine inches long, by six lines and three quarters in a diameter, kindled it completely. This being destroyed by accident, he tried the third, eight inches long, by seven lines in diameter, which succeeded equally well.

When the instrument is made to act, and the spunk kindles, a bright flash, which fills the capacity of the tube, is seen, and this light is more vivid in proportion, as the compression is more rapid. If the compression be less powerful, the spunk does not kindle, but in the upper part of the tube, a light vapour is perceived, which falls in undulations on the piston. When this has disappeared, if the piston be drawn back, the vapour will re-appear, as long as there is any air in the tube. These effects may be produced several times, in succession, merely by pushing the piston with the hand. This vapour is so thin and diaphanous, that it is not perceptible in a strong light. It requires a sort of twilight to see it well.

But whence arises this vapour, and what is its nature? Assuredly it is not furnished by the materials of the instrument. It can, therefore proceed only from what it contains, from the atmospheric air. Now, according to the present state of our knowledge, the air contains only nitrogen, oxygen, and a very small portion of carbonic acid—All gasiform substances, which are kept in this state by the great quantity of caloric that penetrates them, and are consequently heavier than it. But in compressing the air contained in the tube, what is the substance that must first give way? Is it not that which is lightest, the caloric, that general solvent, that principle of fluidity and volatilization, which gives wings even to metals, to raise themselves in the air? Is then the vapour in question, caloric, rendered visible by approximation of its particles, which are compressed by the surrounding air, as air becomes visible in passing through liquids? This idea is not stated by M. Desmortiers as a thing proved, but he says, that it acquires greater probability from the following experiments.

He substituted hydrogen for common air, and the vapour shewed itself as before; but the spunk did not take fire. With carbonic acid gas, and with nitrogen, the effects were the same. The latter, which contained a little nitrous gas, gave a denser vapour. Oxygen, lightly compressed, yielded a vapour more rare and transient, than that of the common air. It had scarce-

ly fallen on the piston, when it rebounded and disappeared. When he compressed oxygen with a proper force, for producing inflammation, the spunk, which commonly takes fire only at the anterior part, was almost burned. Yet, for this experiment, he used a copper instrument, the piston of which lost air so much, that it would no longer kindle spunk with common air.

To the probable objection, that the vapour proceeded from the greasy matter on the piston, and that it may be expanded by the heat produced by the friction.—M. Desmortiers, answers. 1,—The vapour should not show itself, before the greasy matter is deposited on the sides of the tube; yet it appears at the first stroke of the piston, before the tube becomes greasy 2,—It should shew itself below the piston, in the part which the piston has left; but, on the contrary, it always shews itself above. 3,—There is no vapour, when the piston loses much air, if the friction be ever so rapid. 4,—The vapour should be more apparent, when the piston exerts its friction throughout the whole length of the tube, than when it is confined to a small part of its upper extremity: yet the reverse frequently happens. 5,—When the air is entirely decomposed, no more vapour appears, but it shews itself again, if the smallest portion of fresh air be introduced.

As it was essential to ascertain, whether the vapour did not contain an acid principle, M. Desmortiers fastened to the surface of the piston, with a little green wax, a piece of muslin, dipped in infusion of litmus, and afterwards dried. After twenty strokes of the piston, the colour was not changed. He put on a second piece of muslin, larger than the first, and the edges of which were loose. This burned all round, and the colour of the rest was not altered. And, lastly, a third piece, which was wet, experienced no change of colour.

From these experiments, M. Desmortiers draws the following conclusions.—That no acid principle is developed: that all aeriform substances, as well as common air, produce a light vapour: that no other gas, except oxygen and common air, kindles the spunk: that oxygen produces a much more powerful combustion, than common air, and consequently, that oxygen acts an important part, in the inflammation: that, as it can exert its action, only when set free, by the decomposition of the common air, of which it constitutes a fourth part, it follows, that the air contained in the tube is decomposed by the simple force of compression: that the vapour produced is not owing to the oxygen, since it shews itself equally in gases which contain no oxygen: that this vapour is the effect of some agent common to all gases: and, that we may presume, it is caloric itself, rendered visible by the sudden approximation of its parts

in a small space, where it rises to a temperature, that is increased in the oxygen, so as to kindle the spunk.

M. Desmortiers is induced to believe, since the air is decomposed by rapid compression, that the luminous meteors frequently perceived in hurricanes, are not always the effects of electricity. He has several times observed, on these occasions, that Saussure's atmospheric electrometer affords no signs of any. He mentions an instance which occasioned to himself no less surprise than damage.

Surgical Annular Saw. By Mr. Thomas Machell.—*Trans. Soc. Arts. Vol.* 30.

This saw is stated to be particularly calculated for the division of cylindrical bones, surrounded by muscles, blood vessel, or nerves, and with less injury to those parts than by any other instrument in present use.

In operations upon the cranium it has the superiority over the trephine, and Mr. Hay's saw, as it can be applied to the cranium in every form or posture, and remove any depressed portion of bone, with the greatest safety and speed. Mr. Cline and Mr. Whatley, Mr. Machell says, have seen the instrument, and expressed their opinion, that it will be found very useful in many operations; and its singular property of cutting deeper than its centre, renders it likely to prove of great utility in a variety of surgical and mechanical operations.

Mechanical Instrument to work Addition of Numbers with accuracy and dispatch. By Mr. J. Goss.—*Trans. Soc. Arts. Vol.* 30.

The wheel which Mr. Goss has contrived to produce the effect stated, has four circular rows of figures upon its face. The first row, which is nearest the teeth on the circumference, denotes pense, the second shillings, and the third and fourth denote the total number of pense or shillings, &c. thus: if 64 in the third row, should be under the index, in casting up pense, 4 under, or next before the index, would appear in the first row, and the next red figure passed over by the index would be 5, which signify 5s. 4d. the red figure or figures nearest the index, signifying shillings, and the black figure or figures before the index, the odd pense. In the second row, the black figure before the index signifies the number of odd shillings, and the next red figure the

number of pounds. Before the work is begun, the red figures 360, 180, 9, 15, must always be placed next before the index, and then the operator begins to cast up the row of pense. If he should have 5s. 4d. he sets down the 4d. under the bill, and brings back the red figures 360, &c. again before the index; then with the brass handle he moves round the wheel five divisions, and goes on with the row of shillings, &c.

Observations.—To facilitate operations in arithmetic, to those whose early education has been defective, is benevolent and useful; but we conceive that Mr. Goss's invention must be limitted to that class of people; as many manifest objections arise to the general adoption of his plan. The first consists in the danger of causing mechanical operations to become substitutes for results, in which intellectual calculations should be principally concerned, and for the accuracy of which, an appeal must ultimately be made to patient investigation and rational deduction.

Apparatus, by means of which Blind People can both learn and teach Music. *By* Mr. MATTHEW COOKE.—*Trans. Soc. Arts. Vol.* 30.

Mr. Cooke styles his contrivance "The Blind Musician's Guide," and professes, that it will enable all persons deprived of sight, to become acquainted (on the supposition however, that they are endowed with an exquisite sense of feeling!) with every character of music, in less than a week's time, and that as they progressively improve in the science, they will, with the assistance of a master, more easily acquire a perfect knowledge of music by his machine, than by any hitherto invented.

Mr. Cooke states, that the apparatus displays, at one view, every character in the science of music.

That by the introduction of numerical figures, the blind person will instantly know what particular finger is to be put on the key of the piano forte, or organ—that their utility, also, is obvious in performing thorough bass, as they form the ground work of that admirable system, and are absolutely necessary to discover to the practitioner from what source the laws of harmony are derived; as without the knowledge and constant use of figures, no person can properly execute on the piano forte, or organ, even the most common tune, in a skilful or scientific manner.

An accompanying plate exhibits a psalm tune properly figured, and is intended as an illustration of thorough bass. The notes may be also figured, to shew that a particular finger must be

applied to the identical key of the instrument to which the figured note alludes. By this method the blind musician will readily acquire a good habit of fingering, and at length be capable of executing the most difficult passages with ease and freedom.

Mr. Cooke proceeds to observe, that when the blind pupil has gained a competent knowledge of thorough bass, he must acquire the science of composition. For this purpose the machine exhibits a complete score of the treble cliff, the alto cliff, and the tenor cliff, each displayed in their respective order and situation.

Mr. Cooke informs us that the usual mode of instructing blind persons in the theory of music, consists in the use of a wooden apparatus, or frame board, with a number of holes filled with moveable pegs, the heads of which are cut into different shapes and forms, to give an idea of musical characters. But he complains of this system, as being peculiarly intricate and perplexing, and that the machine is very limited in its operations, containing about 600 different pieces, with only 18 varieties of character; whereas the apparatus which he has contrived, and for which he has received the gold medal from the Society for the encouragement of Arts, contains 941 pieces, with 71 varieties of character.

This new machine may be packed in a case three feet long, one foot three inches wide, and 4½ inches in depth; and as the characters are made of brass, they will endure any conveyance, either by sea or land without injury. The price of the apparatus is £21.

Observations.—All modes calculated to increase the rational enjoyments of the opulent blind, or to enable those in an independent situation, but rich in talent, to turn their genius to the purposes of personal emolument, as well as public gratification, answer an important purpose, and we hail every effort which is likely to produce this end. Having the pleasure of knowing several excellent musical performers of this description, we are inclined to think respectfully of the former modes, by which blind persons have been taught to practise on the instruments specified by Mr. Cooke. But must remark that Mr. Cooke states, that his new apparatus exceeds in advantage the old modes, by the addition of 341 pieces to 600, and at the same time *quadruples* its variety of characters.

Description of a Temporary Scaffold, by means of which the outside walls of houses may be repaired, or beautified, with equal safety, and at a less expense than usual. By Mr. Joseph Davis.—*Trans. Soc. of Arts, Vol.* 30.

This simple and effective contrivance (to use Mr. Davis's own words) consists of nothing more than a couple of planks, to which two others are nailed, forming a sort of trough, or moveable scaffold, on which the workmen stand, and which is suspended at any height at pleasure. To each end of this trough, is fixed a frame of wood, in the top cross-pieces of which two pullies are fitted, and round these the ropes, by which the scaffold is suspended, are passed. The ends of these ropes are made fast to two beams, or scaffold poles, which project out of the upper windows; or they may be fixed over the parapet, or by any other means, as may be thought proper. Two single pulley-blocks are also suspended from these poles, and the rope, after passing under the pullies, passes over the pullies in these two blocks, and the ropes, or falls, come down to the machine, and are made fast to any convevenient part of it. Therefore, by drawing these ropes, the workmen can, with the greatest ease, raise or depress the suspended scaffold to any place, where it is wanted.

Mr. Davis states, that the machine which he used, was twenty-six feet long, and cost him two pounds, ten shillings; and that a single machine may be made thirty-six feet long, and united to any length, and when not in use may be folded up, and put by as a common ladder. He remarks, also, that this plan of a scaffold prevents the necessity of breaking up the pavement, or of giving the least interruption to passengers in the street.

Observations.—The utility of Mr. Davis's temporary scaffold is obvious, in relation to operation of a slight kind. But he must forego the merit of originality of invention, as, many years ago, we witnessed the adoption of a similar apparatus, in the repairing and beautifying of a church tower, in one of the Midland Counties.

Description of the Chirographagis, or Instrument intended to form the Hand in Writing, so as to manage the Pen with correctness. By Mr. Thomas Perry.—*Trans. Society of Arts, Vol.* 30.

This instrument consists of five pieces of wood, fitted together, the principal of which is a small flat board of mahogany, lying flat upon the table, and the child's wrist is confined down in a concavity upon it, by a piece, which is likewise concave, and

is united to the first piece, by two little straps and buckles; in this an upright piece is mortised, and an horizontal piece slides up and down upon it, so that it can be fixed at any height, by a thumb screw. In the under surface of the bottom board, a dove-tailed groove is made, in which a piece is fitted which may be slided in and out to any required length. It is not fitted at right angles to the underpiece, but inclined to it in such an angle, as is suitable to the hand in writing.

In order to use this instrument, the hand must be put between the concave boards at almost two inches above the wrist, and the little finger placed over, not upon the sliding stick, which is to be moved according to the size of the hand, so that the tip of the little finger may be near the end of the stick. The cross bar, which is to come under the chin of the pupil, must be screwed on the perpendicular bar, and the machine fastened with the straps, only tight enough to prevent the hand from turning round.

Observations.—An erect posture of the body during the employment of writing, especially to those who are much engaged in it, is a matter of no small moment. And discerning instructors of youth will be ever anxious to secure this habit to their pupils. Their diligence in forming it, will be stimulated by a conviction of its importance, not only in regard to the acquisition of correctness and freedom in the art of writing itself, but in reference to constitutional tendencies to asthma and consumption, which a contrary position is too apt to increase and mature. Is it not, also, reasonable to conjecture, that many individuals have injured the organ of vision, and become near-sighted by being permitted to form the latter habit?—In the prevention of these evils, Mr. Perry's contrivance appears to us important; and, if unattended with the obstacles, which possibly children in an extensive establisment, or their friends, may raise against its adoption, we are not left to doubt respecting its utility.

Method of relieving a Horse fallen down in the Shafts of a loaded Cart. By Mr. JOSEPH MARTIN—*Trans. Society of Arts. Vol.* 30.

The engraving which accompanies Mr. Martin's account of his invention, represents a common cart, with the shafts detached and lying on the ground. The connection of the shafts of the cart when in use are formed by two screw-bolts, one of which passes through the bed of the cart, and also through two iron hinges, by which the shafts are united to the cart. Besides these

screw-bolts two steady pins, or bolts without heads, also pass through holes in the shank of each of the hinges, and two nuts are screwed on to fasten them when the cart is in use. But if the horse falls down, so that the weight of the cart is caused to rest upon the fore-ends of the shafts, he is confined between them by the weight; and prevented from rising.—The method of relieving a horse in such a situation is thus effected. The locking bar is first removed from the staples of the shafts, with which the body of this, like most other carts, is provided, for the purpose of turning up, and discharging its contents. This being done, a man must creep under the cart from behind, and first put down the legs, or stays, which were before turned up out of the way, beneath the cart; then unscrewing the nuts, the shafts will fall down completely detached from the body of the cart, and nothing then prevents the horse from getting up, the cart remaining supported in front by the legs. An additional leg is folded up beneath the cart, and is of such a length that it will, when set upright, support the cart in an horizontal position, and is used to support the cart when lifted up whilst the shafts are fixed on again. The legs are provided with iron hooks, which retain them steadily in their places, when the weight of the cart tends to throw them forwards. The additional leg is, also, provided with a similar hook.

New Experiments on the Combustion of the Diamond and other Carbonaceous Matters in close Vessels. By M. Guyton Morveau.—*Ann. Chim. Tom.* 84.

The important question of the identity of the diamond and pure charcoal in their chemical nature appeared to have been pretty nearly decided by a number of valuable experiments, particularly those of Messrs. Allen and Pepys, but some slight sources of error and uncertainty still remaining, M. Guyton Morveau has repeated his former experiments on this subject, with a much improved apparatus and additional precautions.

The apparatus is described first with great minuteness, but which would not be exactly understood without reference to a plate. It will be sufficient here to state, that it consisted of a thick tube of platina bored out of a solid piece, and long enough to be laid horizontally across a small black lead pot made into a blast-furnace. To each extremity of the platina tube, a glass tube was soldered which led on each side to a mercurial gazometer, but in its way it dipped into a larger tube, bent in the form of the letter U, and filled with bits of fused muriate of lime, and kept

at a low temperature by being surrounded with ice. By this means any gas could be expelled from the gazometer on the one side to that on the opposite side, passing in its way first through one of the tubes filled with bits of muriate lime, then through the platina tube heated strongly in the furnace, and then through the other tube with muriate of lime before it reached the opposite gasometer; and being twice cooled to the freezing point, when in contact with the muriate of lime it could not fail to deposit all the hygrometric water which it contained.

The oxygen gas employed was obtained from oxymuriate of potash, and the mercury in the gazometers was carefully dried. In the estimation of the quantities of gasses used and obtained, they were first reduced by known rules to the common pressure of 0.758 metre, and to the temperature of 12. 5° centigrade thermometer, which correspond respectively to 29. 843 inch barometer, and 54.9° Fahr. The change of volume for each degree of the centigrade thermometer was reckoned at 0.00375.

Mr. Guyton then gives the specific weights, and the composition of all the gasses and substances employed or concerned in these experiments, which he assumes as data; They are as follows (in the French measurement).

The litre or cubic decimetre

	grainme.
Of oxygen gas weighs	1.3435
Common air.....	1.2247
Azotic gas.....	1,1987
Hydrogen gas.....	0.1032
Carbonic acid gas....	1.8372

The composition of water is assumed as 85.662 per cent. in weight of oxygen and 14.338 of hydrogen.

That of the carbonic acid is 72.624 per cent. of oxygen, and 27.376 of carbon.

That of carbonate of barytes 22.1 per cent. of carbonic acid 77.9 of barytes.

The carbonic acid gas produced being absorbed by barytic water, the composition of carbonate of barytes is of course essential. This reagent was preferred to lime water, as the great bulk required of the latter enables it (as M. de Saussure has observed) to absorb sufficient oxygen gas to throw some error in the results.

Barytic water, on the other hand, will absorb nine times as much carbonic acid as an equal quantity of lime-water.

We shall give the leading particulars of one or two experiments:

Combustion of Oak Charcoal.—A piece of oak charcoal freed from the bark was first kept three quarters of an hour at a white heat, imbedded in charcoal powder, in a crucible. When removed, 2.015*gr.* of this charcoal were placed in the platina tube of the above described apparatus, and the tubes holding the muriate of lime were then filled with bits of this salt and accurately weighed. One of the gazometers were then charged with 2.750 litres of oxygen gas (equal to 2. 684 at the standard pressure and heat) the platina tube was then made white hot in the small black-lead blast furnace, and kept so for half an hour, during which time the oxygen gas was passed three times backwards and forwards from one gazometer to the other, going twice through the muriate of lime, and once over the heated charcoal in each passage. When all was cold only 0.580*gr.* of charcoal remained in the tube, so that there had been 1.435*gr.* consumed. The muriate of lime had gained 0.065*gr.* of moisture, which (if reckoned as water generated from hydrogen in the charcoal, with part of the oxygen gas employed) would indicate only 0.00932 of hydrogen in the 1.435 of charcoal consumed, or less than $\frac{7}{1000}$ of its weight.

Combustion of Diamond.—A small tray or cage was made of a piece of platina plate, and drilled with small holes, into which was put 1.3 gr. of diamonds, and the whole was conveyed into the middle of the platina tube in the furnace. A given quantity of oxygen gas, of known degree of purity, was passed thirty times backwards over the heated diamonds in the way described above. When cold the diamonds were all consumed, except 1.5 milligr. so that 1.2985*gr.* had disappeared. The muriate of lime had acquired an increase of 0.043*gr.* The gas remaining after the operation was put in contact with the barytic water, and the unabsorbed residue was detonated with hydrogen gas to extract the unconsumed oxygen, all of which quantities were properly estimated. The results of this experiment were, that if all the oxygen that had disappeared be converted to carbonic acid it would indicate only 1.193*gr.* of carbon consumed (according to the composition of 27.376 per cent. of carbon) whereas 1.285 of diamond had really disappeared, being .1055 more than the quantity estimated from the carbonic acid or above $\frac{8}{100}$ of the whole. "It remains therefore (says M. "Guyton) to account for the excess actually consumed which "was not found in the platina tube, and was not estimated "to enter into the composition of the carbonic acid. Can this "be considered as another ponderable constituent part of the

Diamond?" The author then proceeds, to shew that this can hardly be the case, and that owing to the mode in which the barytic water was used, part of the carbonic acid would probably escape its action; and besides, the water condensed in the muriate of lime was so small, that its hydrogen (supposing it to be a constituent of the diamonds) would not exceed $\frac{4}{1000}$ of their weight, which would go but a little way to account for the excess of $\frac{6}{1000}$ above mentioned. M. Guyton adds too, that as the crystallization of the diamond takes place in the humid way, it is not improbable that it may contain a very minute quantity of water of crystallization, which therefore will account for the moisture condensed in the muriate of lime, without the necessity of supposing any hydrogen as a constituent of the diamond

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Observations.—It must be remembered that some years ago, M. Guyton published some experiments in the 31st vol. of the Annales de Chimie, on the combustion of diamond in oxygen gas, by the assistance of a powerful lens; in which this eminent chemist thought that he had established the apparently probable conjecture which had been previously made, that diamond was the pure carbonaceous principle, and that charcoal was pure carbon in its first or lowest state of oxygenation. From this it would of course follow, that if equal weights of diamond and charcoal were oxygenated in the highest degree, and thus brought to the state of carbonic acid, the diamond would require more oxygen, and would produce more carbonic acid than the charcoal. Or in other words, if 100 parts of carbonic acid be proved to contain from 27 to 28 parts of charcoal, they must contain considerably *less* than 27 per cent. of diamond.

These first experiments of M. Guyton have been not only disproved, both by all subsequent observation, and the antecedent and highly valuable researches of Mr. Tennant, but are totally disproved by all that can be inferred from the present series of experiments, since those would even shew (if no allowance be made for incorrectness) that a given weight of carbonic acid must contain *more* diamond than charcoal, as a quantity of diamond has disappeared during the combustion, which the author only accounts for, by supposing a very sensible imperfection in the mode of absorbing by barytes, the entire quantity of carbonic acid produced.

In complicated experiments of this nature, it would be unreasonable to expect perfect agreement, but at any rate, no inference of any chemical difference between diamond and charcoal, in favour of the oxygenation of the latter, can at all be made out; it is therefore rather singular that the author should conclude a strictly experimental research, by entertaining an

inference totally opposite to the results of his own experiments, though supported by very forcible analogies.

He observes that, very strong marks of a low stage of oxydation in charcoal, are furnished by its enormous difference from diamond in density, hardness, transparence, and inflammibility; by the lustre which charcoal acquires by being deprived of water and hydrogen, and by its increased difficulty of combustion in this state, in which it approaches more to the quality of diamond. These facts (which are beyond dispute) can receive no plausible explanation, but by admitting common charcoal to contain such a portion of oxygen as will constitute it *oxyd of carbon.*

An occurrence took place in these experiments, which shews how nearly the fine jargons approach the diamond in appearance: one of the supposed diamonds was found totally unaltered after being long kept white hot, in contact with oxygen in the platina tube, but on examination, it was found to be a crystal of jargon, which had passed through several practised hands as diamond, and was only detected by this accident. All the stones however were rough and unpolished.

In a supplement to this paper in a succeeding Number of the Annales de Chimie (No. 256) the author collects some other facts, shewing in the diamond, analagous chemical effects to those of charcoal in the decomposition of nitre, the conversion of iron into steel, the conversion of sulphate of alumine into sulphuret, and lastly, the decomposition of water. The latter experiment was performed at the Polytechnic School in the following way: a given weight of diamond fragments was enclosed in a platina tube, lying across a furnace. The tube was made white hot, and then some vapour of water was passed through from a small retort of boiling water at the end, and the gasseous products were passed through barytic water at the other end, and then collected for further examination. The gas was mixed with an equal bulk of oxygen, and detonated by Volta's eudiometer, and two-thirds of the diminution in volume, by the detonation, were considered as hydrogen. The general results were that part of the vapour of the water was decomposed over the heated diamonds, its oxygen producing carbonic acid with the consumed diamond: and its hydrogen remaining in the gas after passing through the barytic water, and detonating with the oxygen afterwards added. The respective products here obtained, accord very well with the estimation of 26.5 per cent. of carbon in carbonic acid, and 14.338 per cent. (by weight) of hydrogen in water.

Experiments on the Fuming Sulphuric Acid of Nordhausen. By M. Vogel, *of Bayreuth, (extracted from the original German).—Ann. Chim. Tom.* 84.

A peculiar kind of sulphuric acid, highly esteemed by artists, who employ this acid, has long been prepared at Nordhausen, in Saxony, which has the property of exhaling, when exposed to the air, dense white vapours. Many chemists have considered this as a combination of sulphureous acid gas, and sulphuric acid, similar to that which is prepared by passing the gas through the concentrated acid, or by dissolving sulphur in sulphuric acid. The object of Mr Vogel's experiments, is to examine the truth of this hypothesis, and particularly to discover, whether this acid has a different degree of oxygenation from the common sulphuric acid.

The common Nordhausen sulphuric acid was first distilled by itself in a glass retort, on a sand bath, and the receiver surrounded with snow, and the process made as gentle as possible, by which means, the peculiar *fuming acid*, which is the object of this research, was obtained in the receiver, as a dry tenacious crystallized mass, much resembling asbestus in appearance, as long as the temperature was kept low. Towards the latter part of the distillation, some common sulphuric acid, became mixed with the other product.

The Nordhausen acid therefore, contains obviously, two acid substances, one is the *fuming acid*, concrete and crystallized at a moderate cold, and the other is common sulphuric acid.—It is the former alone which is here examined.

This fuming acid, when obtained by slow and careful distillation, is a dry crystallized substance, so that it may be held in the naked hand for some time without inconvenience. It remains solid in a close vessel, at 60° or 65° Faht. but when more heated, it takes the form of a colourless transparent vapour, which has so strong an affinity for moisture, that it produces a dense white vapour, whenever it comes in contact with moist air. Hence it is, that the solid acid itself, when exposed to the air in common circumstances, is constantly covered with white fumes. When this acid is mixed with water, much heat is given out, and flashes of light, if the quantities are large, and it becomes common pure acid, producing with the different bases, all the common sulphates; it does not appear, however, by the most careful trials, that the water is at all discomposed by mixture with the fuming acid, so that we are yet ignorant, whether the fuming acid is more or less oxygenated than the common sulphuric acid. Neither can the fuming acid be re-produced by distilling with flowers of sulphur, the residue left after extracting the fuming acid from the Nordhausen acid.

The combination of the fuming acid with sulphur, exhibits some very singular appearances. M. Vogel distilled the Nordhausen acid by itself, and received the fuming acid in a vessel, containing flowers of sulphur. The sulphur became brown, and part of it liquified, and another portion formed beautiful blue crystal, of the exact hue of a dilute solution of indigo, passing first through intermediate shades of brown and green.

The author gives a more particular examination of the blue and the green fuming acid, which leads him to the conclusion, that this difference of colour, depends on different proportions of sulphur.

The general results of these experiments are:

That the fuming acid is not a compound of sulphureous acid gas and sulphuric acid, and cannot be obtained by any known method of combining sulphur and sulphuric acid: that the fuming acid does not absorb oxygen by exposure to air. That when diluted with water, it does not appear to decompose this fluid, but yet it forms in this state only the common sulphates, with the usual bases; that it forms with sulphur, liquid and solid compounds of different colours, brown, green, and blue, which have much analogy with Dr. Thompson's muriated sulphuric acid; and that phosphorus burns in the fuming acid as in common air, forming phosphoric acid, and causing sulphur to be separated.

Observations.—This singular modification of sulphuric acid deserves further notice. The conjecture of Chaptal of its being a more highly oxygenated acid than the common sulphuric, seems fully disproved, both by the present experiments and by others, undertaken many years ago by Mr. Dolfuss, and by Morveau. The singular colours which it forms with sulphur, are we believe, now first noticed by M. Vogel.

On the production of the Brown Oxyd of Lead, in a way not before noticed. By M. CHEVREUL,—*Ann. Chim. Tom.* 84.

There are three oxyds of lead, well known to chemists, the yellow, the red, and the brown, which have all different degrees of oxygenation: the yellow being the lowest of the three, and the brown the highest. This oxyd is also the base of most of the soluble salts of lead, so that when the red oxyd, is digested in nitric acid, a portion of it loses so much oxygen, as to be reduced to the state of yellow oxyd, and thus to form nitrate of lead, whilst the remainder of the red oxyd, absorbs the oxygen lost by the other portion, and becomes brown oxyd. Or in other words, one portion is oxygenated at the expense of the other. The above mentioned fact has long been known, and is

the way in which the brown oxyd is usually prepared; but M. Chevreul, has here noticed another accidental production of the brown oxyd, under the following circumstances: some flint-glass, (which contains much oxyd of lead), in fine powder, was long digested in nitric acid for the purpose of analysis. The portion insoluble on this acid, was washed and calcined, and then heated in a platina crucible, with thrice its weight of pure potash. Then the melted mass was digested with water, an alkaline solution was obtained, containing much silver and yellow oxyd of lead, and it was observed that the platina spatula, (which had remained in the crucible the whole time), had at its extremity an alloy of platina and metallic lead, and the bottom of the crucible was also lined with a similar alloy. The diluted alkaline solution deposited a crystallized brown powder of a metallic appearance, which was at first mistaken for iridium, but when it had been washed and covered with nitric acid, the acid took a fine rose colour, which it lost by filtration, an appearance which the brown oxyd of lead also assumes in a like situation. This brown powder heated by itself in a glass tube returned to the state of litharge, with effervescence; and when treated with muriatic acid, it disengaged much oxymuriatic acid, and formed brilliant plates of muriate of lead. Hence it would appear that part of the yellow oxyd of lead, which entered into the glass had been decomposed into metallic lead and brown oxyd; and that this decomposition was determined by the united action of the affinity of platina for metallic lead, and of the yellow oxyd for an additional portion of oxygen.

On Camphoric Acid and its comparison with Benzoic Acid, by Mr. Bucholz. Ann. Chim. Tom. 84.

The camphoric acid is one of those dubious products of oxygenation by nitric acid, whose identity as a peculiar acid has been doubted, and by some it has been considered as a modification of the benzoic acid. Mr. Bucholz however appears to have made out sufficient marks of distinction, to entitle the camphoric acid to its place, among the list of peculiar acids. It is best prepared according to the author in the following way: Put 2 ounces of camphor in a retort, add a pound and a half of nitric acid, of 1. 25 sp. gr. and half a pound of strong nitric acid, of 1. 55 sp. gr; distill off in a moderate heat half the acid, return it again into the retort, and re-distill half the contents, and repeat the same a third time. After the second rectification, a very little oil of camphor, appears floating on the surface of the acid. When the process is finished, the camphoric

acid will be found floating on the nitric acid liquor, in the form of a little butyraceous matter, from which most of the nitric acid may be separated by decantation, and the remainder may be got rid of, by dissolving the butyraceous mass in boiling water, and allowing it to crystalline on cooling. From 2oz. of camphor, about 5 drams may be obtained, besides 1 or 1½ drams, which may be estimated to remain in the acid nitrous liquor. Camphor therefore will yield scarcely half its weight of camphoric acid. The distillation must be kept very slow, and moderate towards the end of the process, or part of the camphoric acid will be decomposed, which is known by the brown colour, which the liquid assumes.

The camphoric acid crystallizes on cooling the hot solution, in the form of white feathers. Its taste is decidedly acid, leaving a little bitterness in the throat. It requires 100 parts of cold water, and 10 or 11 parts of boiling water, for its solution. About 100 parts of cold alcohol dissolve 16 of camphoric acid, but boiling alcohol dissolves it in any proportion. The camphoric acid heated by itself is partly sublimed and partly decomposed into an oil, and an acid liquor, and much charcoal remains.

In all these properties the camphoric acid differs very decidedly from the benzoic, and it also forms very distinct salts with the several alkaline and earthy bases, as the author has here shewn.

Analysis of Benzoin; by Mr. Buchholz.—*Ann. Chim. Tom.* 84.

Some good benzoin was first digested repeatedly in common spirit of wine, which left undissolved a small residue of sand, and bits of the wood, whence the gum was procured. The clear spiritous solution was then mixed with water, and the milky liquor distilled in an alembic till all the alcohol had come over. This product reddened litmus, which shewed that a part of the acid had risen along with the alcohol, and this was afterwards recovered, by exposing the spirit to the air, and allowing it to evaporate spontaneously, leaving the pure acid behind. The watery liquid in the retort, separated by filtering from the resin, deposited a further quantity of benzoic acid by mere cooling, and at the same time a thin stratum of a soft balsam. All the filtered watery liquid was evaporated and cooled at intervals, by which successive crops of crystallized benzoic acid were obtained, and a quantity of extractive matter, was also collected. The soft balsam above mentioned was boiled in water, which dissolved a

portion, but left another part untouched, which afterwards dissolved both in alcohol and æther. This substance the author considers as *sui generis*, and by no means a compound of benzoic acid and resin. But the greater portion of the benzoin, was the proper resin of benzoin which remained behind, after the watery solution had been separated. The results of this analysis are the following:

	dms.	grs.
Twenty-five drachms of benzoin yielded		
Resin of benzoin	20	50
Benzoic acid	3	7
Balsam, resembling Peruvian balsam	0	25
Aromatic principle soluble in water and alcohol	0	8
Wood and impurities	0	30
	25	0

The author gives the following way of obtaining very pure benzoic acid; digest one part of benzoin with 4 of alcohol for a few days, and filter the solution. Put this in a retort or alembic, with thrice its quantity of water, and distill the milky liquid, till all the spirit has come over. Decant the boiling liquor left in the retort, filter it whilst boiling, and put it into a shallow vessel, to crystallize. The resin left on the filter may be again treated with alcohol and water, and distilled like the first portion, and the watery liquid left in the retort after this second operation again filtered and added to the first filtered portion. Then boil down the liquid to an eighth, and let the acid crystallize by cooling; lastly, collect all the portions of benzoic acid, dissolve it in 50 or 60 parts of boiling water, boil it a little while with some fresh burnt charcoal powder, filter the hot solution, and on cooling, it will furnish beautiful crystals of pure benzoic acid.

Analysis of native arseniated Cobalt. By Mr. BUCHOLZ.—*Ann. Chim. Tom.* 84.

The analysis of this mineral was very simple: the mineral was first heated by itself, by which it lost 22 per cent. in mere water. The residue was dissolved in nitric acid (leaving a little quantity untouched) and mixed with acetite of lead, by which much arseniate of lead precipitated. But on evaporating to dryness, thus driving off the excess of nitric acid, a notable portion of arseniated lead was also recovered, which had been held in solution by the excess of free acid. The residue was re-dissolved, and

treated with sulphuric acid to separate the excess of lead added, and the oxyd of cobalt was thrown down by alcali.

The composition of this mineral, according to this analysis, is merely about 37½ per cent. of arsenic acid, 39 per cent of oxyd of cobalt, and 22½ of water. The most useful practical fact, is the solubility of a portion of the arseniate of lead in the excess of nitric acid, so that the whole of the arsenic acid cannot be estimated by mere precipitation with acetite of lead, but the excess of acid must be got rid of, and the arseniate dissolved by that excess of acid, must then be separately obtained, and added to the former portion.

Account of an accidental detonation of Fulminating Silver. By VEAU DELAUNAY, *Professor of Natural Philosophy.—Journ. de Physigue, for Nov.* 1812.

THE accident which occurred to the author, is thus related, "In preparing Howard's fulminating powder for one of my lectures, having almost compleated the process, (that is to say, the alcohol having been added to the nitrous solution of silver, and the whole having boiled so as to give much ætherized vapour,) I decanted the whole into a conical glass, and stirred it with a glass tube, previous to filling it, when immediately a most violent explosion took place, the glass broke to pieces, and the glass rod was projected several feet from me, together with all the liquid contents of the vessel, which has stained the ceiling of the room permanently."

The author fortunately escaped materially injury himself, but he relates another similar accident with the same preparation, owing to the mere shaking of a table, which held some of this fulminating compound drying on a filter, by a child laying a glass barometer tube down upon it. The detonation was violent, and two drams of the fulminating silver exploded, but fortunately, without any serious mischief.

Observations.—These accidents shew the cautions necessary in handling this hazardous compound, and the danger even of keeping a moderate quantity of it in a mass. It seems that silver furnishes the most violently detonating compounds of all the metals, since fulminating mercury made in Howard's manner, may be prepared (as has hitherto appeared) with perfect safety, and has been used in experiments on expansive forces, with great freedom.

REVIEW OF SPECIFICATIONS OF PATENTS,

PUBLISHED IN THE REPERTORY OF ARTS.

Mr. F. PARKINSON's *Patent for an improved Still or Boiler, for preventing accidents by fire, and for preserving spirits and other articles from waste, in the operation of distilling and boiling. Dated Sept.* 1813.—*Repert. of Arts, No.* 140.

The invention of the patentee is extremely simple, and apparently is quite adequate to the end proposed. It consists of a broad rim of copper or any other metal, firmly soldered to the outside of the still at any convenient part below the juncture of the boiler and still-head, and furnished with a long spout, by which any over-boiling liquor is caught, as it streams down the outside of the still, and conveyed to a separate receiver, before it can reach the furnace door, which is the place at which the liquor usually catches fire, in accidents of this sort. This outside rim or circular trough, must be embedded in, and supported by brick-work.

Observations.—Very dangerous accidents every now and then occur in distilleries, owing to the over-boiling of the contents of the large boilers, either from urging the fire too much, or from any accidental obstruction of the worm-pipe. In these cases, the pressure of the over-boiling spirit, breaks through the luting between the boiler and still-head, and in running down, is apt either to insinuate itself between the still and the brick-work, in which it is set, or to pour down over the furnace door; in either of which cases, it instantly takes fire, and produces an explosion, nearly equal in effect to that of gunpowder, whilst the stream of liquid fire that spreads in every direction, renders all access highly dangerous, if not impracticable. The expansion of metal is so much greater, and more rapid than that of any earthy bodies, that it is hardly possible to set perfectly light in brick-work, any metallic vessel, that is to be instantly in a state of alternate heating and cooling, and even if this could be effected, there would always be danger of any over-boiling spirits taking fire at the furnace door. It seems therefore, that no better contrivance than that of the patentee could well be devised, and we think it is likely to add much security to a hazardous business.

Mr. DAKING'S *Patent for heating Liquors, for the Manufacture of Leather. Dated May,* 1813.—*Repertory of Arts, No.* 136.

The patentee constructs a wooden vat or trough, thirty feet long, twenty inches deep, and thirty inches wide, which will contain as much liquor as is usually required, in what tanners denominate a tap or spender. At the bottom of the inside of this vat, runs a copper pipe, about ten inches in diameter, communicating at one extremity with a furnace, of which it is the chimney, and turned up at the further end, about three feet, to allow the escape of the smoke and heated air. As this metallic pipe lies at the bottom of the liquor in the trough, it is obvious that the liquor will receive the heat, transmitted through the sides of the pipe. The spent bark will furnish sufficient fuel for the purpose. The pipe must be kept down by pieces of wood, stretched across the trough, to prevent its rising when the trough is filled with liquor.

Mr. C. A. SCHMALCALDER'S *Patent for certain improvements in Mathematical Instruments. March* 1812, *Rep. Arts.* 129.

On the edge of the mariner's compass, theodolite, or other instrument for measuring angles of azimuth, Mr. S. places a three-sided prism; this produces a single reflection, and enables the observer to read the divisions upon the card, at the same time by raising his eye partly above the angular edge of the prism, he sees the subject of observation by direct vision. In this manner the line of collimation becomes the index to the card divisions, and the azimuth or bearing may be taken and read off at one observation.

By the application of a four-sided pyramid, on the same principle to a plumb line, spirit level, or the divisions of a theodolite, or other instrument, Mr. S. is enabled to see the object by direct vision; the position of the plumb line, &c. by means of one reflecting or inclined surface, and to read off the divisions by the other reflecting surface.

The adaptation of these prismatic reflectors to the telescope, Hadley's sextant and similar instruments, enables an observer to obtain the angles of azimuth, and altitude without the usual necessity of assistants.

Where a magnifying power is required, Mr. S. produces it by making certain surfaces of the prism convex.

Observations.—Although we have seen a similar invention to this, which may make us doubt a little of its originality in the present case, we do not hesitate to give great praise to Mr. Schmalcalder, for the completion of this elegant arrangement.

It gives great precision to observations of much importance, and has the advantage of being very portable.

Mr. HANDFORD'S *Patent for a Travelling Trunk, on an entire new construction. Rep. Arts. No.* 131. *Second Series.*

This trunk is constructed with mahogany and other *strong and durable composition*, covered with leather of superior quality, secured with angle and edge pieces of metal, &c.

Observations.—This "strong and durable composition" notwithstanding the requisite perspicuity of a specification, is still as great a secret as before the date of the patent. We lament this, as in all other respects this entire new construction appears to differ in no respect from the usual well-made trunks.

Mr. T. DEAKIN'S *Patent for a new method of making Knife, Scissurs, and various other Cases or Sheaths. Rep. Arts. No.* 133.

The cases specified are to be made of rolled copper or other metal, and to the form of the instrument intended to be inclosed; they are then to be covered with cloth, or tin, or paper, &c. or any other flexible and fibrous materials to give toughness and durability to the varnish or lacquer, with which the exterior surface is to be coated.

Observations.—Whatever novelty there may be in this "*new method*" it certainly does not appear in the specification.

Mr. W. CASLON'S *Patent for an improved Printing Type. Rep. Arts. No.* 133.

Instead of casting the type of the usual height of 7-4ths of an inch, Mr. C. proposes to give it but 3-16ths, the deficiency is made up by stands adapted to the various kinds of types; both the type and stands are sloped or levelled off wherever possible,

in order to reduce any unnecessary weight of metal. The stands may also be of wood, and attached to the type by nails, or otherwise.

Mr. O. states the advantages attending these types to be their weighing about one half less than the common types, and these occupying, when put away, from one-third to one-seventh only of the room necessary for those now in use.

Observations.—The increased and increasing number of readers, and the present unprecedented high price of books, render every attempt of the nature under consideration highly laudable and important. The long celebrity of the name of Mr. Caslon in this particular branch of the arts, would induce us to believe that no important circumstance would be admitted in any improvement of letter founding, which may be publicly sanctioned by that name. Still we wish to be convinced that the extra time and trouble of composing, necessary in this combination of type and stand, will not eventually, more than counterbalance the larger weight of metal, an expense which is incurred in the first instance only.

The steadiness of this new letter when locked up, except in chases made on purpose, appears to us to be very doubtful.

Mr. W. GILPIN'S *Patent for an improved method of manufacturing Augurs. Rep. Arts. No.* 128.

A heavy weight or hammer is attached by a rope passing over a pulley to the foot of a man; this is raised by a sudden motion of his body, and descends upon a pair of dies; these fashioned to the intended augur or tool, give the metal placed between them the form desired.

Observations.—This is merely an application of the common button presses to the specified purpose, its pretensions as an invention or discovery are very low.

RETROSPECT

OF

PHILOSOPHICAL, MECHANICAL, CHEMICAL AND AGRICULTURAL DISCOVERIES.

No. XXXVI.] *September, October, November, December.* [1813.

NATURAL PHILOSOPHY, ARTS, MANUFACTURES AND CHEMISTRY.

On a Method of Freezing at a distance, by WILLIAM HYDE WOLLASTON, M. D.—*Sec. R. S. Phil. Trans. for* 1813.

If an attempt were made to freeze water by mere evaporation in the vacuum of an air-pump (Dr. W. observes), the receiver must be of large dimensions in proportion to the quantity of water employed, otherwise its capacity would set too confined a limit to the quantity of vapour that will rise, and consequently to the degree of cold produced. According to the commonly received estimates as to the respective quantities of heat in ice, water, and steam, 32 grains of water at 62° must lose about 5 grains by evaporation, in order to convert the remainder into ice (making no allowance for the accession of heat from the surrounding bodies), and as water expands to 1800 times its former bulk when it assumes the gaseous state, these 5 grains require a dry vacuum of 5+1800=9000 grains of water.

To avoid the necessity of so large a vacuum, Mr. Leslie has most ingeniously employed an extensive surface of some substance that strongly absorbs and condenses the vapour of water (sulphuric acid in preference to any other), which, by extracting from the receiver the aqueous vapour as fast as it is formed, keeps up the vacuum within it, and thus allows of the congelation of a large quantity of water in a moderate space. Dr. Wollaston has employed another way of applying the same principle of preserving a vacuum round the water to be frozen, in the little apparatus here described. This is no other than the common glass toy

called the *pulse-glass*, and consists of a bulb of glass blown at each end of a piece of glass tube, and bent at right angles to the tube. One of the bulbs is half filled with water, and the other is hermetically sealed at the moment that the whole is kept filled with steam, by heating over a lamp a considerable time, till all the air is expelled, so that when the glass is cooled, one bulb remains half full of water, and the other bulb and the intervening tube are perfectly empty of air. Now, if the empty bulb is immersed in a mixture of salt and snow, the aqueous vapour proceeding from the water in the other bulb is congealed as fast as it is produced; and in a few minutes the water is frozen solid. The distance between the two bulbs may be very considerable without impairing the effect. Dr. W. has given this little instrument the name of *Cryophorus, or Frost-bearer.*

On a Method of Drawing extremely fine Wires, by W. H. Wollaston, M.D. F.R.S.—*Ph. Trans. for* 1813.

Artists who use silver wire in large quantities, sometimes begin with a rod three inches in diameter, and ultimately obtain wires of no more than $\frac{1}{6000}$ of an inch in thickness. If in any stage of this process a hole be drilled longitudinally through the silver rod, having its diameter one tenth of that of the rod, and if a wire of pure gold be inserted so as to fill the hole, it is evident that by continuing to draw the rod, the gold within it will be reduced in diameter exactly in the same proportion as the silver; so that if both be thus drawn out together till the diameter of the silver is $\frac{1}{600}$ of an inch, then that of the gold will be only $\frac{1}{10000}$, and of such wire, five hundred and fifty feet will weigh no more than one grain. Now, if such silvered gold wire be steeped for a few minutes in warm nitrous acid, the silver alone will be dissolved, and the gold wire will be left untouched.

In this way the Author succeeded in making gold wire of very great tenuity, but he experienced great difficulty in drilling the hole in the silver rod and inserting the gold. He therefore made the experiment of substituting platina for gold wire, as its infusibility would then allow of the silver to be poured round it in a fluid state, without injuring the texture of the platina. A cylindrical mould one-third of an inch in diameter was made, in the centre of which was fixed a platina wire $\frac{1}{10}$ of an inch in diameter, and the intervening space was filled with melted silver.—When this rod was drawn to $\frac{1}{10}$ the platina which it contained in its centre was reduced to $\frac{1}{1000}$, and by successive reduction and application of nitrous acid to dissolve away the external coat of silver platina wires of $\frac{1}{4000}$ and $\frac{1}{10000}$ were obtained, which are

very useful for applying to the eye-pieces of astronomical instruments, and are as fine as can be required for such purposes, since in a thirty inch telescope, $\frac{1}{1800}$ of an inch subtends only a second of a degree.

The most convenient method of managing the removal of the silver from these delicate wires, is to bend a portion into the shape of the letter U, with small hooks at its upper extremities, by which it may be suspended and immersed in the nitrous acid, and the silver will then be dissolved away from all the part between the hooks, leaving the hooks themselves as a means of conveying and attaching the wire wherever it may be wanted. The platina wire is sufficiently visible to the naked eye, when the diameter does not exceed $\frac{1}{3000}$ of an inch, but when it is much less it eludes the sight, and the slightest breath of air would carry it away, if it were not retained by the ends that still retain the silver.

It is of consequence to have the platina in as dense and solid a state as possible before it is drawn out; and for this purpose, Dr. W. first brings a considerable globule of it into perfect fusion, under the flame of a large spirit lamp, impelled by a blow-pipe fed with oxygen gas, (which was first suggested by Dr. Marcet) after which the globule is hammered out and wire-drawn before it is coated with the silver. Dr. W. has succeeded in obtaining small portions of platina wire, which, by calculation, could not exceed one thirty thousandth part of an inch in diameter, but at $\frac{1}{18000}$ of an inch, though quite invisible to the naked eye, it would support 1¼ of a grain before breaking.

An Account of some Organic Remains found near Brentford, by the late Mr. WILLIAM KIRBY TRIMMER.—*Phil. Trans. for* 1813.

The late Mr. Trimmer, of Brentford, in digging clay for the manufacture of bricks and tiles, frequently found the remains of animals and extraneous fossils, which led him to collect a valuable cabinet of these organic remains. The above paper contains a description of the strata in which these interesting remains are found.

These have been collected from two fields not contiguous to each other. The first field is half a mile north of the Thames, at Kew-bridge: its surface is twenty-five feet above the Thames at low water, and it consists of five strata as far as has been hitherto sunk. The first is a sandy loam from six to seven feet thick, in which no remains of any organized body has occurred to the author. The second stratum is a few inches of gravel, often containing the shells of snails, river fish, and a few bones of land animals. The third is from one to five feet of a calca-

reous loam, and in this have been found the teeth, bones, and horns of the ox and the deer. The fourth stratum is from two to ten feet of gravel, containing water, and often with a thin coat of peat lying above it. It is this stratum that abounds the most with the teeth and bones of both the Asiatic and African elephant, of the hippotamus and the ox. When this stratum dips into the clay beneath, it is seldom without organic remains. The fifth stratum is the main stratum of blue clay, which extends under London, and all the valley of the Thames, to a considerable extent. The average depth of this blue clay is not less than two hundred feet beneath the surface of the level lands, and proportionably deeper under the hills, as in the striking example of Lord Spencer's well, at Wimbledon, which penetrates the bottom of the blue clay at five hundred and sixty-seven feet from the surface. The organic remains in this stratum are almost entirely marine.

The remains of hippotami are so abundant in some of these strata, that in turning over an area of 120 yards, parts of six tusks of this animal have been found, besides remains of the deer, ox, and elephant. One of the ox horns was 4½ feet in length, following the curve, and five inches in diameter at the larger end. Most of these break down when they are attempted to be removed. The bones are not worn and rounded by attrition, as must have been the case if exposed on a sea-beach; but they all lie quite dispersed and separated from those to which they would be naturally united in the entire animal.

Experiments on the Alcohol of Sulphur, or Sulphuret of Carbon. By J. Berzelius, M. D. F. R. S. *and* Alex. Marcet, M. D. F. R. S.—*Phil. Trans. for* 1813.

In our last number, (page 253) we gave a pretty full account of a series of experiments on this singular compound made in France by M. Cluzel, and of a subsequent examination of it, and of M. Cluzel's analysis, by Messrs. Berthollet, Thenard, and Vauquelin. We have now to mention an equally interesting memoir, on the same subject, by the two eminent chemists who have here united their skill and science. Not to weary our readers with a recapitulation of the experiments of the French chemists above related, we shall here only notice the most important practical part of the experiment of Drs. Berzelius and Marcet, under the heads in which they have arranged them.

1. *Preparation and general properties of the Alcohol of Sulphur.*

It is prepared by slowly volatilizing sulphur through charcoal, kept red-hot in a porcelain tube, and condensing in water the oily liquid thus formed. The fluid thus obtained is of a pale yellow colour, and deposits in a crystalline form the sulphur which it holds in mere solution, which may be as much as $\frac{1}{4}$ of its weight, and is altogether independent of that which is essential to the constitution of the liquid. To obtain the liquid perfectly pure it should be rectified by a second distillation, at a heat not exceeding 110°, putting a little dry muriate of lime into the retort to absorb any moisture. The fluid which comes over is then quite pure, and some sulphur remains behind.

The alcohol of sulphur thus prepared is quite clear and limpid, has an acrid pungent taste, and a very peculiar nauseous smell. Its specific gravity is 1,272. It boils at about 105°, but it evaporates in a common temperature with extreme ease, producing a greater degree of cold, even than ether, as will be mentioned in the succeeding article. It does not congeal by any known cold. It is highly inflammable, burning with a bluish flame, and copious fumes of sulphureous acid, but without depositing any moisture. It readily dissolves in alcohol, ether, fixed and volatile oils, and slowly, in the alkalies. No acid but the oxymuriatic has any action upon it.

2. *Whether Hydrogen be present in Alcohol of Sulphur.*

A portion of the alcohol of sulphur, in the state of vapour, was driven through melted muriate of silver, and again condensed unchanged. Neither was any portion of the metallic salt reduced, which would have been the case had the alcohol of sulphur contained any hydrogen, as this would have formed water with part of the oxygen present, and thus would have enabled the muriatic acid to become gasseous.

Various metallic oxyds, such as red oxyd of iron, black oxyd of manganese, oxyd of tin, were in the same manner heated, and the vapour of the alcohol of sulphur passed through them, which reduced them to sulphurets, but no water whatever was generated. From these, and other experiments, the authors infer that this substance contains no hydrogen.

3. *Experiments to ascertain the presence of Carbon in Alcohol of Sulphur.*

The existence of carbon was found by burning some of the vapour of the alcohol of sulphur in oxygen gas, both by Volta's eudiometer, and by kindling a portion in a glass capsule, and then

introducing it into an atmosphere of oxygen gas under mercury. The heat generated was very intense, and the products of the combustion were sulphureous acid gas, which was directly absorbed by water, and a large residue of carbonic acid, as shewn by lime-water.

4. *On the Proportions of Sulphur and Carbon in Alcohol of Sulphur.*

Several methods of determining this point were attempted with various success; but that which gave the most satisfactory results was to pass the vapour of the alcohol of sulphur through red hot oxyd of iron. A glass tube, filled with red oxyd of iron coarsely ground, and protected on the outside by lute, was put into a small furnace in a slanting position. A small retort, holding a determined quantity of the alcohol of sulphur, was hermetically sealed to the upper end of the glass tube, and to the lower end was joined another glass tube, having a bulb in its middle, and terminating in a bent end, which dipped under a jar of a mercurial bath. The bulb was kept cold by a mixture of salt and ice. When the tube holding the oxyd of iron was red hot, the alcohol of sulphur was heated with extreme caution by a small spirit lamp standing at a little distance; and the vaporized alcohol of sulphur was thus slowly expelled through the heated oxyd of iron. The process was so gradually conducted, that it took six hours and a half to evaporate 15 grains of the alcohol, for several previous trials had failed from hastening the process too much. In this cautious mode of operating, every atom of the alcohol of sulphur was decomposed, as no liquid whatever was condensed in the intermediate bulb. The products of this decomposition were to be found in the contents of the heated glass tube and in the gasses collected over the mercury bulb. The oxyd of iron in the tube, (which weighed eight times as much as the alcohol of sulphur used) was partly converted into a yellow brilliant metallic-looking sulphuret of iron, which was afterwards analyzed by long boiling with nitro-muriatic acid to acidify the sulphur, separating the oxyd of iron by ammonia, and combining the sulphuric acid with barytes, by means of muriate of barytes. The sulphureous and carbonic, acid gasses which formed the entire gasseous products in the jar of the mercurial-bath, were exposed for an hour to the contact of brown oxyd of lead, by which the sulphureous acid was totally absorbed, and the carbonic acid left untouched. The latter was afterwards taken up by caustic potash. The oxygen of these two gasseous acids was presumed to be furnished by the oxyd of iron, as the iron in the sulphuret is in the metallic state.

By combining these facts, and calculating from them accord-

ing to established data, the authors conclude the alcohol of sulphur to contain

Sulphur	84.83	100.
Carbon	15.17	17.89
	100.00	117.89

These proportions very nearly correspond with those that would express the composition of two atoms of sulphur and one of carbon, assuming, with Mr. Dalton, the atom of sulphur to be 13 and that of carbon to be five, which also does not much differ from Sir H. Davy's computation.

In an Appendix to this valuable paper, by Professor Berzelius singly, he adds some remarks concerning the combination of alcohol of sulphur (or as he terms it with more correctness, *carburet of sulphur*) with the alkaline bases, in which the carburet appears to act as a distinct chemical agent, and therefore he calls these compound *carbo-sulphurets*.

Carbo-sulphuret of ammonia is formed by throwing up successive portions of ammoniacal gas to liquid carburetted sulphur in a close vessel over mercury. By degrees a yellow uncrystallised saline crust is formed, which is the carbo-sulphuret of ammonia. If this is heated in the vessel in which it is formed it sublimes unchanged, but if exposed to the air or to moisture, it is partially changed to hydrosulphuret of ammonia and carbonic acid.

Similar carbo-sulphurets of barytes and lime may be formed by heating carburetted sulphur with these earths. The formation of carbo-sulphuret of potash and soda, is prevented by the impossibility of obtaining these alkalies free from water in their composition, as it is now fully proved that even the solid fixed alkalies melted at a strong red heat still retain a considerable portion of water, which cannot be expelled from them but by neutralizing them with a fixed acid.

When carburetted sulphur is long digested with liquid potash at a very gentle heat, the former substance is decomposed, and the mixture desolves itself into a hydrosulphuret, a carbosulphuret, and carbonate of potash.

Experiments on the production of Cold by the Evaporation of Sulphuret of Carbon, by ALEX. MARCET, *M.D. F.R.S. Phil. Trans. for* 1813.

In this paper the author relates the very astonishing reduction of temperature produced by the evaporation of liquid sulphuret of carbon, which far exceeds that produced by ether or any other known evaporable fluid.

If the bulb of a small spirit thermometer be covered closely with a bag of fine flannel, or in preference, with a piece of fine

lint, and a few drops of the sulphuret poured on it, the spirit rapidly sinks from 60° to about 0°; and if this be done in the receiver of an air-pump, as the exhaustion proceeds, the spirit will sink in one or two minutes to 65—or—70, by the time that the rarefied air supports only a quarter of an inch of mercury; and if the pump is capable of exhausting to an eighth of an inch, a cold of 80—to—82 is produced. If therefore the thermometer bulb be filled with mercury instead of spirit, the mercury will be hard frozen with the greatest ease, and the remarkable contraction which it undergoes at the moment of its passing to the solid state may be readily estimated. The receiver used for this occasion should be large, as the vapour of the carburetted sulphur is apt to injure the valves of the pump if it passes in too concentrated a state.

The author adds some practical observations on the way of preparing the sulphuret of carbon. The large earthen tubes of an inch and a half in diameter, are preferable to the small porcelain tubes commonly sold. Fresh pieces of sulphur may be pushed in upon the charcoal when the first are exhausted, as the occasional admission of a little air does not injure the process. About half a pint of the liquor may thus be obtained in a day's time. The same tube will seldom answer twice.

On the means of procuring a steady light in Coal Mines without danger of explosion, by William Reid Clanny, M.D. *of Sunderland.—Phil. Trans. for* 1813.

The number and magnitude of fatal accidents that have happened in the English coal pits, is truly lamentable. Dr. C. here relates several, by which in the space of seven years upwards of two hundred pit-men have been killed, besides many wounded; and more than three hundred women and children left in consequence destitute of support. Such accidents as these may well excite the ingenuity of able men to prevent their recurrence.

The author describes in this paper a lanthorn or candle-lamp, which he conceives will be found a great improvement. The lamp is made of strong copper or japanned iron, with a very thick glass window. The chimney of the lamp after passing out of it is bent downwards into a cistern of water, through which the heated air passes, and the air that comes in from below is impelled from a bellows through another cistern of water at the bottom of the lamp. The current of air, therefore, necessary for the combustion of the candle, is kept up by the action of the bellows, which drives it in through the lower cistern of water, and out through the upper, and thus the candle is perfectly insulated within the lamp, whilst the current of air carries off the snuff as

it forms. Hence if the air sent in contains so much hydrogen as to become explosive, the explosion it is presumed will not extend beyond the limits of the lamp itself, this being strong enough to resist being burst out, and no other mischief will arise. The bellows may also, if required, be connected with a gasometer of pure atmospherical air brought down from above, 40 gallons of which are enough for an hours consumption.

Observation.—This plan of insulating the light appears well contrived for the purpose in some situations, but it must require the constant attention of a boy, or else some mechanical power to keep the bellows at work, and we fear it would prove much too cumbersome when thin seams of coal are wrought, in which the pitman is almost bent double for want of room to stand upright. It does not appear too that Dr. C. has actually tried the strength of his lamp by filling it with an explosive mixture and firing it, which would be necessary before its security could be fully depended on.

On a New Detonating Compound, by Sir H. Davy.—*Phil. Trans. for* 1813, *Part I. Page* 1, *and Part II. Page* 243.

In these two papers Sir H. Davy describes a new and most remarkable detonating substance, first discovered in France by M. Dulong, and announced as being a compound of oxymuriatic acid and azote, appearing in the form of a heavy oil exploding with extreme violence by the gentlest heat. In this first notice of M. Dulong's discovery, the exact process for preparing it was not given, but its dangerous properties were but too well proved, by the loss of a finger and an eye to the discoverer. With the general idea of the composition of this compound, Sir H. Davy was enabled to prepare it, but it had nearly cost this eminent Chemist the same sacrifice as the Inventor, his eye having been dangerously wounded by the fragments of a glass vessel burst by an unexpected explosion.

It was prepared in the following way:—Into a phial containing six cubic inches of chlorine (oxymuriatic gas) was poured a saturated solution of nitrated ammonia at the heat of 50° in common day-light. The gas speedily lessened, an oily film collected at the top of the liquid, which soon fell to the bottom in the form of small oily globule, one of which taken out and gently warmed in water suddenly exploded with a brilliant light. These oily globules therefore are the detonating substance in question, and it is produced by passing oxymuriatic gas through a solution of nitrate or oxalate of ammonia (and probably any other of the

ammoniacal solutions) or through a weak solution of pure ammonia, at a heat of from 40° to 50°. Only small quantities should be used, for on attempting to collect a larger portion in a series of tubulated bottles filled with the different ammoniacal liquors, the whole heated spontaneously, and exploded with extreme force, shattering the apparatus to pieces. Neither should the chlorine and the solution be shaken together, even at a low temperature, as it was this simple operation which caused the explosion, by which Sir H. D. had nearly lost his eyesight.

This detonating compound is a limpid slightly yellow oil, heavier than water, in the proportion of about 1.65, of a nauseous smell, and emitting pungent fumes, particularly distressing to the eyes. It evaporates in a moderately warm heat, and the vapour is easily absorbed and decomposed by water: the substance itself is also soon diminished in water, more rapidly as the water is warmer, but with the constant risk of explosion on using artificial heat. A globule no bigger than a grain of mustard, when exploding under water, will shatter most glass vessels in which it may be contained.

When a particle of this compound touches oil, phosphorus, phosphorized ether and alcohol, it detonates vehemently; but, in alcohol alone, it whitens slowly, and then loses its explosive powers. In all cases of explosion, where the contents are preserved, a quantity of azotic gas is given out. When this substance is acted on by mercury under water, corrosive muriate of mercury is formed, and azote escapes. It has no action on sulphur, nor on resin, nor on the solutions of those inflammables in alcohol.

In Sir H. Davy's second paper he informs us that Mr. Dulong, the inventor, prepares it by passing a mixture of chlorine and azote through a solution of sulphate or muriate of ammonia, but the azote is obviously not necessary, as chlorine alone will answer as well.

Sir H. Davy has given a number of experiments on the decomposition of this compound, all of which tend to shew that its only constituent parts are azote and chlorine, the former of which generally escapes in the form of gas, under any chemical action, and the latter produces the known compounds of chlorine and the substance by which the decomposition is effected. The most accurate results were obtained by the intervention of mercury. Seven tenths of a grain of the detonating compound, put into a tube of mercury, and inverted, produced 49 grain measures of azote, and a white mercurial powder, which was a mixture of corrosive muriate and calomel. The results of this experiment

would give the composition of the detonating oil to be 57 of arote to 643 of chlorine by weight, or 19 to 81 in volume.

When the detonating substance is exposed to liquid muriatic acid, the products are muriate of ammonia and chlorine, which the author, according to his hypothesis of muriatic acid explains, by supposing that the hydrogen of the acid forms ammonia with the azote of the detonating substance, whilst the chlorine of the acid mixes with the chlorine of the detonating substance, and appears in its proper form as chlorine gas, or is absorbed by the remainder of the liquid acid. As the estimation of the chlorine gives the means of finding the composition of the detonating substance, it is necessary to find the quantity of chlorine absorbed by the liquid muriatic acid, and this the author (with his accustomed ingenuity) performs by measuring the bleaching or discolouring power of a given portion of the liquid on a solution of indigo, for it is found that simple muriatic acid does not affect the sulphate of indigo, but muriatic acid that has absorbed chlorine gas, has a discolouring power directly proportioned to the chlorine which it has taken up. Therefore, (previous experiments having determined the quantity of chlorine indicated by the bleaching of a given measure of indigo liquor) the author caused a grain of the detonating compound to be decomposed, and its chlorine absorbed by six cubic inches of liquid muriatic acid, and this destroyed the colour of seven measures of indigo liquor. On the other hand, the same quantity of indigo liquor was bleached by 2.2 cubic inches of chlorine, and hence this quantity of chlorine was estimated to be contained in a grain of the detonating substance. On the mean of two experiments, Sir H. Davy finds the elements of the detonating substance to be nearly the same as had been determined by the action of mercury above given, so that it may be taken at about 26 azote to 261 of chlorine by weight, or four volumes of chlorine to one of azote.

On a Substance from the Elm-Tree called Ulmin. ***By*** JAMES SMITHSON, Esq. F. R. S.—*Phil. Trans. for* 1813.

The substance now called Ulmin was first discovered by the celebrated Klaproth, in a resinous matter obtained from an elm-tree sent to this chemist from Palermo. It has since been examined by Dr. Thompson, and now again by Mr. Smithson, on a part of the identical specimen sent to Klaproth some years before.

This paper of Mr. Smithson's consists of the full particulars of a chemical analysis which will hardly admit of abridgement.

Ulmin, when in lump, is black; but its proper colour is red, or reddish brown. It dissolves in water, forming a blood-red liquid when much concentrated, but yellow when dilute. Ulmin is remarkable, as containing a very large proportion of pot ash, which is naturally united with and neutralized by a resinous matter, but when any acid is added to a solution of ulmin in water, the pot-ash passes to the acid employed, and the resin separates. Thus nitric acid with ulmin produces nitrate of pot ash and the resin of ulmin; muriatic acid produces muriate of pot ash and resin, and the like. Mr. Smithson estimates the quantity of pot ash in ulmin to be about a fifth part of the whole.

Observations.—Ulmin was first obscurely noticed by Vauquelin, in an analysis of a morbid juice of the elm, published in the 21st volume of the Annals de Chimie. It was afterwards analyzed more fully by Klaproth as already mentioned, and since by Dr. Thompson, whose specimen was collected on an elm near Plymouth, and who has given it the appropriate name of ulmin.

It dissolves abundantly in water, and the solution, after evaporation and dryness, is equally again soluble in the same liquid. But neither alcohol nor ether have any action on it, and in this respect it differs from vegetable extract. Its most remarkable character is the large proportion of pot ash which it contains, but the alkaline properties are so completely masked by the resin naturally united to it, that its solution in water barely alters vegetable colours as alkalies do in general; and yet, on the other hand, the alkali does not require to be elicited by combustion, but is extracted from the ulmin by the action of any acid. The proportion of alkali in ulmin is far greater than in any other known natural vegetable product (tartar perhaps excepted) and prodigiously greater than in the elm wood itself, which does not yield more than about $2\frac{1}{2}$ per cent. of ashes after combustion, of which the alkaline portion can hardly amount to a fourth or a fifth part. Even dried fumitory, which is the richest in alkali of any entire vegetable yet examined, contains hardly eight per cent. of salt, part of which also is neutral salt and carbonic acid. Ulmin is particularly interesting also as being, to all appearance, a *morbid* exudation, and it would be truly valuable to the physiology of vegetation to gain some knowledge of the changes that attend this singular evolution of alkali and resin.

On the Oxymuriate of Lime. *By* Mr. JOHN DALTON. *Annals of Philosophy.* No. I..

The oxymuriate of lime now so extensively used in bleaching and calico-printing is prepared both in a liquid and solid form,

but chiefly in the latter. The liquid is prepared by sending a current of oxymuriatic gas into a mixture of lime and water, which is kept constantly stirred till the lime is dissolved. The solid oxymuriate is made by sending the same gas into dry lime, slacked with as little water as possible, and thus brought to a fine powder. This compound is a soft white powder, smelling of oxymuriatic acid, and partially soluble in water, yielding a liquid nearly the same as that obtained by the former process. When this liquid is evaporated, however, the dry salt is not *oxymuriate* of lime, but *muriate* of lime, owing to the conversion of the oxymuriatic acid into muriatic. This prepared oxymuriate of lime always consists of a mixture of oxymuriate of lime, muriate of lime, and a portion of lime uncombined, and as the former of these three substances is the only one which possesses any of the bleaching property for which the salt is valued, it becomes an object of some importance to devise some mode of analysis by which these three substances can be separately estimated. As evaporation to dryness of the clear solution of the salt converts the oxymuriate to muriate of lime, it is obvious that this mode of analysis cannot be conveniently adopted.

Mr. Dalton has given the following analytical experiments: One hundred grains of the dry oxymuriate of lime were heated to redness in an iron spoon. The loss was 32½ grains. Water was added to the residuum which took up a portion, leaving an insoluble residue. The solution was muriate of lime, containing 18 of lime. The residue being afterwards dissolved in muriatic acid gave 21 of lime. Hence the whole of the lime combined and uncombined, of the 100 grains of the oxymuriate was 39 grains. A second experiment managed in somewhat of a different manner gave 37 of lime.

By the next experiment it was attempted to find the relative proportions of muriatic and oxymuriatic acid in the oxymuriate as prepared. A certain quantity of muriatic acid was first added, in order to expel the oxymuriatic acid, and convert the whole to muriate of lime, and the perfect expulsion of the oxymuriatic acid was found by the solution no longer destroying colour. Nitrate of mercury was then added, by which all the muriatic acid was precipitated with mercurial oxyd in the form of calomel, which was collected and weighed, and one-ninth of the weight was reckoned to be muriatic acid. Then, deducting from this the weight of the real muriatic acid belonging to the portion added to expel the oxymuriatic, the remainder was the muriatic acid originally existing in the substance analized. In this way it appeared that a third of the lime existing in the soluble part of the oxymuriate was combined with muriatic acid.

It still remained to find some direct test of the quantity of oxymuriatic acid. The usual way of measuring this acid is to find how much of any given coloured liquid (sulphate of indigo for example), a given portion of the oxymuriatic solution will saturate so as just to destroy the colour. This way serves well enough for comparison between different bleaching liquids, but will give no information as to the precise quantity of oxymuriatic gas contained. Mr. Dalton has here introduced a new test for this substance, which he finds to answer extremely well, it is a solution of the *Green Sulphate of Iron.* As soon as this salt comes in contact with oxymuriatic acid in any form, the black oxyd of iron, which is the basis of this salt, passes to the state of red oxyd, by absorbing oxygen from the oxymuriatic acid; if the sulphate is deficient, the mixture smells strongly of oxymuriatic acid; so that to find the due point of saturation for this test, just so much of the sulphate must be added, that a slight smell of oxymuriatic acid is perceptible; and a very few drops (more or less) will be sufficient to hit this point.

By experiments on the respective saturation of these two substances, which we need not here detail, the author infers the composition of the dry oxymuriate of lime as prepared for use to be as follows:—

Muriate of Lime	13.5
Oxymuriate of Lime	26
Lime	18.5
Water	42
	100.0

The above 13.5 muriate of lime contains 6.5 muriatic acid, and 7. lime: and the 26. oxymuriate of lime contain 14.5 oxymuriatic acid, and 11.5 lime. These proportions of 14.5 to 11·5 are nearly in the ratio of 29. to 24. which numbers accord with those given by Mr. D. as the respective weights of the atom of oxymuriatic acid, and of lime; and hence he considers the *liquid* oxymuriate of lime as composed of one atom of acid to one of lime. On the other hand, there is an excess of lime in the dry salt as usually prepared, and this excess amounts to 18.5 per cent. But Mr. D. does not consider the whole of this lime as a mere uncombined excess, since the mode of preparation seems to show something like a respective saturation of the acid and the lime. He therefore supposes part of this excess of lime to be at first in chemical combination with the oxymuriatic acid, forming a *suboxymuriate of lime* insoluble without decomposition, in which the lime is in double proportion to that of the

soluble oxymuriate of lime; and when water is added, half the lime is deposited, and the remainder enters into solution along with the acid. In the numbers above given, therefore, 11.5 of the 18.5 per cent. of lime that remains undissolved, is the portion that belonged to the suboxymuriate of lime, and the remaining 7. alone is the proper excess of uncombined lime.

Age diminishes the value of the solution of oxymuriate of lime by converting it partially into a muriate; and the same effect is in some degree produced in the dry salt, even when kept in a bottle.

Observation.—We have not given an account of the whole of the author's experiments here detailed, as they are confessedly very imperfect: but he has rendered a real service to the manufacturing chemist by pointing out a mode that promises success in the analysis of this important substance which is now most extensively employed as a discharger of colour in a variety of ways.

On the Causes of the Change of Colour produced by Heat, on the Surface of Steel. By Sir H. Davy.

Annals of Philosophy, No. 2.

Both Dr. Thomson and Sir H. Davy had concluded that the changes of colour on steel produced by different degrees of heat, did not depend on the action of the oxygen of atmosphere, since they were found equally to take place when the steel was heated under oil, or mercury. But Mr. Stoddart had found, that if mercury is quite pure, and fully purged of air, no alteration takes place in the colour of steel heated beneath this fluid, and hence Mr. S. is led to the conclusion that the old explanation of this change of colour, which attributes it to partial oxygenation is the true one. The present experiments are a repetition of Mr. Stoddart's, with some additional ones. Polished steel was heated successively in pure hydrogen gas, in pure azote, in pure olive oil, previously boiled to expel the common air, and in all these instances no change of colour took place. Whence it is reasonable to infer that the various tints of blue, straw-colour, and yellow which heated steel assumes, are really owing to the production of a very thin coat of oxyd on the surface, though this is in too minute a quantity to be made the subject of any direct experiment.

Description of a Resinous Substance, lately dug out of the Earth, at Highgate. By Dr. THOMSON.—*Annals of Philosophy. No. 7.*

In making the excavacation for the Highgate archway, a very considerable number of curious fossils were discovered. One of the most remarkable of these was a resinous body in shapeless masses of various sizes. A specimen of this was examined by Dr. Thomson.

The colour of the Highgate resin is a dirty yellowish brown. It is semi-transparent, with a resinous lustre, brittle, and has a peculiar resinous smell, something resembling that of camphor when heated. Its specific gravity is 1.046; when heated it becomes perfectly liquid, and it catches fire at a lighted candle, burning with a clear yellow flame, much smoke, and a strong resinous aromatic smell. When in lumps it is soluble in water, alcohol, pot ash, and acetic acid. Ether renders it opake, and white, and crumbly beneath the fingers, and dissolves a portion of it, so as to become milky on adding water.

Nitric acid partly dissolves it, and partly converts it to a red coloured substance. When finely pulverized, it is partly soluble in alcohol, but very imperfectly. It burns totally away before the blow-pipe, leaving no perceptible quantity of ash.

This singular substance, as Dr. Thomson observes, approaches the nearest to copal and amber; but is distinguished from the former by dissolving in alcohol, and refusing to dissolve in pot ash: and from the latter, by melting, when heated, readily and without any change of properties after cooling. No probable conjecture can be given as to its origin.

Analysis of the Chinese Gong. By Mr. THOMSON.—*Annals of Philosophy. No. 9.*

The gong is a large circular metallic instrument, similar to the tambourine in shape, from $\frac{1}{15}$ to $\frac{1}{10}$ of an inch in thickness. The metal has exactly the appearance of bronze. It is very elastic and brittle when cold; but as Wollaston has found it is quite malleable at a heat below redness. Dr. T's. analysis gives the composition of the allo, to be merely 4 parts of copper to 1 of tin, without any mixture of lead, zinc, or any other metal. The specific gravity of the gong is remarkably great, being as much as 8.953; but the mere density of its constituent parts in the above proportions of 4 to 1, is only 8.337, so that in the manufacture, a condensation of more than $\frac{1}{17}$ of the whole takes place. The gong metal is considerably heavier than British bell-metal, the latter being only 8.368. The bell-metal examined by Dr. T. consisted of 80 per cent. of copper, 10.1 of tin, 5.6 of zinc, and 4.3 of lead.

On the Construction of a Mole, or Breakwater, in Plymouth Sound. By Messrs. RENNIE, WHIDBEY, JESSOP, JACKSON, HEMMONS, BROWN, *and* BENTHAM.—*Papers of the House of Commons*, 1812.

A Survey of Plymouth Sound was made by the two first of these gentlemen, with a view to the construction of a Breakwater there, by order of the Lords of the Admiralty, in the year 1806. It took place in the month of March, and being near the spring equinox was a favourable opportunity of observing the tides at their greatest elevation and depression.

The importance of the harbour of Plymouth, to the naval interests of this country, is very great. Its situation, depth, capacity, shelter, and anchorage, are unrivalled. The national establishments are also of great magnitude.

This harbour is naturally divided into four principal parts, viz. Cawsand Bay; the Sound; Catwater, and Hamoaze. There are also two smaller ones, named Barn-pool. The first two constitute the entrance, or outward harbour, Cawsand Bay lying nearest the sea. The third and fourth branch off to the eastward and westward, from the interior end of the Sound, and form distinct inner harbours; the fifth is in the passage from the Sound to Hamoaze.

The approach from the Ocean to the Sound is divided into three distinct entrances by two clusters of sunken rocks, distinguished by the names of the Panther and the Shovel, with several smaller ones round them. The first entrance is on the west, through Cawsand Bay, between the main and the Panther; the second, or middle entrance, is between the Panther and the Shovel; and the third, or eastern one, between the Shovel and the main.

The depth of water in Cawsand Bay and the Sound is at all times sufficient for men of war to ride in, during quiet weather; but their open situation exposes them in all southerly gales to a very large swell from the Atlantic; and there is then very considerable danger to be apprehended from vessels striking against the ground, or driving from their anchors. In such weather they cannot make use of Hamoaze or Catwater, the entrance to the first being intricate; and the latter, not having depth or capacity sufficient for men of war.

To shelter one or both of these parts of the outer harbour has, therefore, long been desirable; several plans were submitted to Messrs. Rennie and Whidbey for these purposes, all of which, for various reasons, they rejected.

The plan proposed by Messrs. Rennie and Whidbey themselves is confined to the shelter of the Sound only.

This they propose to accomplish by two moles or break-waters. The principal one, insulated—near a mile in length, and thrown across the middle passage to the Sound, extending at each end, for a small distance into the eastern and western entrances. The other, to be about half the length, and connected with the main land on the eastern side of the harbour; this is intended to cover the eastern entrance, and shelter a small bay, called Bouvisand Bay.

The principal breakwater is formed of three straight lines, the middle one 500 fathoms long, its extremities 175 fathoms each, and their outer ends inclined towards the interior of the harbour, each making an angle of 120° with the middle line. The smaller Break-water, called for distinction, the Pier, is in two straight lines, one of which is also inclined towards the interior of the harbour and greater Break-water.

It is proposed that these moles shall be raised in the first instance, to a height of ten feet above the level of a low spring tide, and that there be good lights on each end of the Break-water.

With these defences, Messrs. Rennie and Whidbey speak decidedly, that at least *fifty* sail of the line may ride in safety within the Sound, in all winds and in any weather, completely sheltered from storms, and secure from any swell, that there will be no risk at all of the decay of the Sound by any deposition of mud in consequence of these erections, and that no doubt can be entertained of the practicability of executing the work.

Messrs. R. and W. state, that the best manner of constructing this work will be by large blocks of stone thrown promiscuously into the sea, in the line of the intended Break-water, leaving them to find their own base: these stones must be large, otherwise, with such a swell as in Plymouth Sound in stormy weather, they would not remain in the place where they are deposited. From observations they have made, stones from about one and-a-half to two tons each, will be sufficient to answer the purpose. Where the water is five fathoms deep, they think the base should not be less than 70 yards broad; and the top about 10 yards, at the level of ten feet above the low water of an ordinary spring tide.

On the sea-side, it is proposed, that the Break-water shall have a slope of three horizontal to one perpendicular, and on the Sound or land side of one and-a-half horizontal to one perpendicular. With these dimensions—and making considerable allowances for the irregular bottom of the sea; the probable greater base it may form; &c. &c. the quantity of stone required will be about two millions of tons. The pier will require about 360,000 tons in addition.

This immense mass of materials is recommended to be pro-

cured, principally from Cat-water and the head of the Sound. The rocks on the other shores of the harbour and nearer the scite of construction, appearing to be incapable of affording blocks of the required weight. This is regretted, particularly as Cat-water is so much more distant, and liable to interruption from winds. No doubt is admitted of the most adequate supply of materials.

With regard to the time required to execute this work, Messrs. R. and W. estimate, that if an 100 sail of vessels of 50 tons each were instantly employed, the Break-water would be raised to 10 feet above low water in four years, but allowing for accidents, they think it would require about six. Calculating that 30 similar vessels would be employed on the Pier, it would probably be completed in three years; but they allow for this six also, the same as the Break-water.

It is recommended that the Break-water be begun upon the Shovel Rocks, and extended in each direction, that its effects upon the Sound may be seen during its progress. If a pier of cut stone be built upon the top of the Break-water, sufficient time should be allowed for the rubble part to consolidate.

The propriety of any internal improvements of the harbour, was also examined by these gentlemen during their survey.

The project of constructing any works in the line of the bridge between Drake's Island and Mount Edgecombe, they deprecate, principally from the crookedness of the entrance to Hamoaze, in which they conceive the tide would be reflected from certain points in a dangerous manner.

The deposition of mud, &c. in the Sound and Cawsand Bay, by the waters which flow from the country, Messrs. R. and W. consider as comparatively small, though they could obtain no evidence of the depth in former years. They are inclined to consider this deposition as much less, than what was stated to them by the pilots, &c.

Still the importance of promoting the greatest possible quantity of water to flow into, and ebb out of, all tide harbours, should at all times prevent the embankments of the creeks and mud-lands within them. Examples of the fatal effects of diminishing this mass of current water, may be pointed out in this country; Portsmouth particularly has been greatly injured.

These effects were early foreseen, and our ancestors were very vigilant to prevent the causes of them. Plymouth and the neighbouring ports were protected by three Acts of Parliament in the reigns of Henry VIII. and Elizabeth, from the injuries likely to be done to them by the sand, &c descending from the tin stream works in the country. This attention is much relaxed in the present day, and Cat-water will probably be destroyed as a harbour in consequence. Of 851 acres, over which the tide flowed at this

place, 312 have already been, or are now embanking. Messrs. R. and W. earnestly recommend that these evidently injurious practices may be immediately suppressed, and that a journal be regularly kept of the soundings of all parts of the harbour.

The Estimate of the probable Expense of a Break-water, and Pier, for the sheltering of Plymouth Sound and Bouvisand Bay.

To 2,000,000 of tons of limestone, in blocks of from one and a half to two tons weight, in the Break-water, at 7s. 6d. per ton..... £.	750,000
To 360,000 tons in the Pier, proposed to be built from Andum Point, at 7s.	126,000
Contingencies, say at £.20 per cent. on the whole..	175,200
£.	1,051,200

Estimate of the probable expense of a cut-stone Pier, and two Light Houses, to be built on the top of the Break-water.

To 42,000 cubic yards of masonry, in the out and inside walls of the pier, at 27s. ..... £.	44,700
To 62,000 cubic yards of rubble filling, between the out and inside walls of the pier, at 6s.....	18,600
To paving the top of the pier with large blocks of stone 8,500 square yards.....	22,950
To two Light-houses, with Reflectors and Argand lamps.....	5,000
Contingencies, £.20 per cent.....	28,650
£.	119,900

In a letter to the Secretary of the Admiralty, Mr. Rennie details the necessary preparatory measures, and states that the probable expense of the first year will be £.60,000.

Mr. WILLIAM JESSOP, in a report dated four months after the preceding one of Mess. Rennie and Whidbey, made in consequence of instructions received by him from the Lords Commissioners, states, that after having perused the papers of Messrs. Rennie and Whidbey, he agrees with them in the position, form, beneficial effects, and probable expense of the works proposed; and considers that it will have no sensible tendency to decrease the soundings in the Bay.

Mr. Jessop is disposed to think that the Break-water should be carried higher than proposed, and probably to the level of high water; and that the body of the pier, especially towards the land, may be constructed of smaller stones, forming the external parts only of large blocks.

There is no difference of opinion between Mr. Jessop and the other gentlemen, with regard to the interior parts of the harbour, he agrees with them in the propriety of making no alteration.

Mr. RENNIE, in a subsequent report, states the means best adapted to carry the proposed works into execution.

Cat-water is still considered by Mr. Rennie as the most eligible spot from which to obtain the materials: the rocks there are of a compact quality, and sheltered from all winds; no other part of the harbour appears to have these advantages in the same degree.

As these rocks are calcareous, and of great advantage to the neighbouring country for agricultural purposes, some objections to their removal are anticipated. These are met by proposing to sell, at an inferior price to the present, all such stones as may be quarried, and found not to be proper for the Break-water.

So far as it goes, this sale will be a mutual advantage; and, in the event of the Cat-water rocks being exhausted, it is expected that the Break-water will have so sheltered the shores between Plymouth and Dock, which are of the same calcareous quality, that they may be quarried, and removed with facility—the future supply will then be abundant.

It is intended that the rock be purchased by Government, and quarried by contract: the contractors to be permitted the use of convicts, provisioned at the public expense, for whom they are to pay a certain rate per diem.

The vessels for the conveyance of the blocks are recommended to be about seventy, in the first instance—each from 40 to 100 tons burden, furnished with a crane to discharge them, and a false floor in their holds, to facilitate the unloading—well-vessels, to discharge by a valve in their bottoms, though the easiest mode, would be extremely expensive, and therefore disapproved.

The vessels are not to be the property of Government, but of contractors.

Moorings for these vessels should be laid down between two lines of buoys: these must correctly mark the position and extent of the Break-water, and great care be taken that the stones are deposited in the proper places.

The line of operation is directed to be begun upon the Shovel rock, and to be continued at both ends to the east and west.

The establishment for the execution of this work should be conducted by an experienced, intrepid, and scientific superintendant. He should have proper clerks and assistants, that there be the greatest regularity and dispatch in all parts, and an unceasing vigilance that the contractors do their duty.

The soundings should be periodically taken, and their variation, if any, marked; all effects of winds, waves, and storms upon the shipping, shores, breakwater, and interior harbour, should be carefully watched and registered, that the construction and extension of the works may be judiciously continued, or altered.

Messrs. JACKSON, HEMMANS, WHIDBEY, *and* BROWN, experienced master attendants, in the government establishments at Plymouth, Chatham, and Woolwich, were requested by the Admiralty, through the medium of the Navy Board, to take the effect of the intended Break-water into their consideration, and to report, in the form of answers, to certain questions, which were, at the same time, proposed. These were first submitted to Mr. Jackson, of Plymouth, and subsequently, with his report, to the others.

The practicability and completion of the work being assumed, the questions were the following, viz.

1. How many ships of the line could be moored in security within the said dyke, or break-water?

2. Is there any danger to be apprehended, in consequence of the moderate depth of the water, of ships striking on their own anchors, or those of the ships lying near them, in the event of driving, or in the act of unmooring in the usual way, at low water, &c. &c.?

3. Would ships be able to get out of the Sound and proceed to sea, with the wind from South-East to South, with as much, or nearly as much, facility, as from Torbay, with the wind between those points?

In answer to the first, Mr. Jackson states, that thirty-six ships of the line may be moored in security within the break-water. Mr. Whitbey considers this as rather under the number; but Mr. Brown advises that the number be confined to thirty, to allow for the possibility of their not being brought to anchor in the exact situations appointed.

Second. The anchoring found in the Sound is so excellent that the experience of many years does not furnish any instance of ships getting foul of their own, or any other, anchors: looking therefore, at the probable increase of smooth water, by the shelter of the Break-water, these gentlemen agree in opinion that no danger is to be apprehended, in future, from the causes mentioned.

Third. Messrs. Jackson and Whidbey state, (and the others agree with them) that from the shelter of the Break-water; the superior tide and back-water; the Edystone light, &c. ships of the line may leave Plymouth Sound, with the winds mentioned, and that with more facility than from Torbay.

Mr. Jackson suggests the placing of several buoys, for the purposes of mooring vessels, and marking she shoal called Scot's Ground. He also thinks a qualified person should be appointed to superintend and direct all the moorings. Upon a plan, Mr. Jackson has delineated the positions of the vessels, allowing a space of 210 fathoms between the centres of the ships on the line of mooring. This is done that they may unmoor at any time of tide, without fear of injury from the anchors of the ships astern. The soundings marked three fathoms South West by South off Donstone, or Blackball Point, he states should be five fathoms.

Mr. Bentham at the time of these communications, held an official situation under the Navy Board; disapproving of the plans of Messrs. Rennie and Whidbey, he thought it his duty to submit, unsolicited, his opinions upon this subject to the Board, that they might be laid before the Lords Commissioners of the Admiralty.

The principal objections of Mr. B. to the design of Messrs. R. and W. are

1st. The great cost,

2d. The great obstruction it offers through its long extent to the existing water-way; and the extensive eddies and shoals that must be the natural consequences.

3d. The great obstruction of the navigable entrance to the Sound, and so increasing the risks to fleets running for shelter.

Mr. B. also states, that the direction in which he should place the Break-water, would probably be different from that proposed by Messrs. R. and W.

In each of the designs submitted by Mr. Bentham, he conceives he has in a very great degree avoided these objections:—two of the designs are proposed to be of masonry, and fixed; the other of wood, and floating.

In the first, a double row of cylindrical masses of stone-work, 50 feet in diameter, built in a new mode, are to be deposited, leaving an interval between each two masses, more than equal to the diameter of one of them. The masses of one row are to be placed opposite to the intervals of the other. A complete interruption to the run of the waves is thus formed, at the same time that the tide would pass freely between the masses, throughout the whole extent of the Break-water.

In the second, a single row of masses is proposed to be deposi-

ted, having arches thrown across the intervals, considerably below the surface of the sea. These would present a barrier to the waves, while the openings beneath would permit the passage of the tide.

But as both these designs would be liable to the third objection, although they remove very much the weight of the two former, Mr. B. proposes as the most preferable in every point of view, a floating break-water of wood, in parts, of a triangular or prismatic form, and held in their places by chains of iron. In this plan, the water-way is not diminished, the tide meets with no obstruction, and, therefore eddies will not be formed; should a ship strike against these floats, little damage would be done to her, compared to that which she would receive from a break-water of stone. Another most important advantage is, that no injury can possibly be done to any part of the harbour. By a trial of the experiment, different lines of position may be tried, with great care, until the most preferable were known; or they might be removed all together, if the desired effect were not produced.

Mr. B. states, that break-waters upon this principle have been constructed with success in a foreign port, and he has himself employed a small one with effect at Sheerness.

Should they be adopted and succeed, no stone will be necessary, and consequently, no vessels and machinery to carry and deposit it.

Estimated Expense of a Break-water, 7,000 feet in length, by distinct masses of Masonry; also of a Floating Break-water, of the same length, formed of floats of Wood.

If of stone according to the first mode, a circular mass of stone, 50 feet diameter, 50 feet high, the bottom and sides of an average thickness of six feet, of which two feet in thickness on the outside, set in Roman cement and sand, a strong coping set in cement only, and the rest in good under-water mortar. £.1568
Levelling and preparing the bottom of one mass 100
Transporting and depositing one mass 100

£. 1,768

140 (No. of masses as above)..... £. 247,520
Contingencies on ditto, at 15 per cent..... 37,128

Grand Total.....£. 284,648

A Break-water, constructed according to the second mode, would require less masonry, yet as the execution would require a little more care and accuracy, the expense may be considered as the same with the former mode.

Estimate for a Floating Break-water of Wood.

One float, 30 feet in breadth and depth, 60 feet in length, laid over with oil of tar, and other cheap oil	£.	970
Four morning drains and fastenings		430
Laying down the moorings of one float		100
	£.	1,500
117 floats, as above		175,500
Prepararions, and other contingencies on ditto, at 15 per cent.		,26325
Grand Total		£201,825

On the Construction of a Break-water, in Plymouth Sound, and a Narrative of Circumstances connected therewith; including some Remarks on the Plan of Messrs. RENNIE *and* WHITBEY. *By* SAMUEL MOYLE, *Civil Engineer.—Pamphlet published by Longman and Co.* 1813.

Mr. Moyle states that his plan has received the approbation of different noblemen and gentlemen, and that he has published it from a desire that his friends might see the reasons of this liberal patronage, and from the conviction that the public official boards have not submitted the project of the Break-water to an extensive consideration and discussion. To the neglect of all other professional men, they have confided to Messrs. Rennie and Whidbey only, the design and execution of a work which will require the "labour of many years, and an expense of many millions"—and which risks the safety of the finest harbour in the United Kingdom.

It is admitted by Mr. Moyle, that the shelter of the Sound is imperiously called for, and that it may be accomplished so that thirty-six or forty sail of the line may ride securely. An accurate survey of the different parts of the harbour, and a close investigation of the plan of Messrs. Rennie and Whidbey, and its consequences, induces him to differ very materially from them as to the best means of obtaining and securing this desirable object.

Some of the principal objections are stated in the following remarks.

At present, the larger ships find considerable difficulty in entering or leaving the Sound against the tide, with light winds; the contraction of the entrance will increase this difficulty to a degree that may render it quite impossible for them to go in or out at such times.

The sea will be thrown into Cawsand Bay in S. S. E. and S. E. winds, this will lessen the depth of water there—and even if it should not, no ship could ride there in safety during a strong gale.

The navigation of the eastern entrance will be dangerous from the great run of tide—none but small craft will be able to use it.

The eddies produced by the entrance of *two* currents, and by their junction within the break-water, are likely to produce more serious injuries to vessels than if they were exposed to a regular swell. The entrance to Catwater may also suffer.

A shoal of considerable extent may be reasonably expected to form within the break-water, in the area of quiet water between entering the currents. Mount's Bay, and Falmouth Harbour are mentioned as examples, where banks have been formed by similar causes.

The completion of the Break-water proposed by Messrs. Rennie and Whidbey, will be difficult, dangerous, and require considerable time. As it approaches the level of low water, it is evident no vessel can safely approach it in blowing weather, or if there be any swell. The deposition of stone by vessels, boats, &c. must therefore go on slowly—thirteen or fourteen years, at least, will be necessary for its complete execution.—It is an important fact that its effects upon the harbour cannot be correctly estimated until nearly the conclusion of the work. Should they then be injurious, they are irremediable.

An experiment has convinced Mr. Moyle that the actual quantity of mud, &c. washed down the harbour is much greater than supposed by Messrs. Rennie and Whidbey. From this he is led to conclude the ultimate ruin of the harbour by their plan: and he states the same "to be the general opinion of nautical and other gentlemen acquainted with the subject, as well as of some of the first engineers in the kingdom."

Mr. Moyle then describes a plan for a Break-water, in the arrangement of which, he states, several noblemen and gentlemen have assisted, and that none of the preceding objections, he conceives, will apply to it.

The Break-water should begin at the shore near Ramscliff Point —and be carried in a diagonal direction across the Sound, over the Shoal Rocks to the Panther—the line to be concave on the side next the Sound.

Cawsand Bay would then be the only entrance to the Sound,

and would probably be deepened by the increased quantity and action of water, produced by this disposition, In S. S. W. and S. W. winds it will be much more sheltered, and ships may anchor there in safety until the tide serves to carry them within the Break-water.

In the execution of this design, as it begins on the land, no ships would be necessary; a very considerable expense and delay would consequently be saved. The stone, Mr. Moyle is of opinion, may be obtained from the cliff, where his plan is proposed to commence, and carried on railways to the spot intended. From these, and other favourable circumstances, attending this design, Mr. Moyle estimates the cost at one-third less than that of Messrs. Rennie and Whidbey, and that it may be constructed in at least one half of the time. The alteration it would produce in the harbour would also be evident, as it proceeded; and the direction and extension be governed by an actual observation of its effects.

To shelter Bam-pool, and all the lower part of Hamoaze, a Pier should be built on the bridge between Mount Edgcumbe and Drake's Island; seven or eight additional sail might then ride safely in Bam-Pool.

The objections to this pier Mr. Moyle anticipates, and proposes to meet them by taking advantage of the low ground between Firestone Bay and Stonehouse Pool. A cut should be made through this in a straight line from the Sound into Hamoaze. All the delay and inconvenience of the present circuitous passage to Hamoaze by the Devil's Point, would at once be removed; the tide from Hamoaze would be carried to the upper part of the Sound, and there meeting that from Catwater, both would be united, and proceed to sweep along the inner face of the break-water—the security of the anchorage ground in the Sound and the shores near Cawsand, would be certain and perfect; no shoals or mud-banks could possibly form in any part.

In September 1812, Mr. Moyle submitted his plan and report to the Lords of the Admiralty. Their Lordships, in answer, stated, that having compared it with the plan then under construction, they were decided in the preference they gave to the plan of Messrs. Rennie, Whidbey, and Hemmans.

Mr. Moyle then publicly addressed Lord Liverpool.

After stating that the opinions of the two noble lords, with whom the project originated, have never been given upon Mr. Rennie's plan and report of the 21st of April 1806, he ventures to conclude, that they would not have recommended that plan to be adopted.

He complains again that Lord St. Vincent, the Navy and

Transport Boards, the Trinity-House, the Port-Admirals, &c. &c. have never been requested to give their opinions upon the propriety of this measure. Several Dock-yard Officers have, indeed, been applied to, but the three questions proposed to them, required no consideration or opinion of the position, practicability, and form of the Break-water, or its probable effects upon the depth, &c. of the Sound, and neighbouring ports. Neither have those important particulars, of an undertaking so novel and extended, been submitted to the examination of any other professional men than Messrs Rennie and Jessop.—Mr. Moyle states, he is far from wishing to depreciate the merits of either of these gentlemen, but from the common liability of all men to error, particularly in new and untried speculations, it is prudent, at least, to consult every possible means of information.

The DockYard at Plymouth, it is said, is not sufficiently extensive for the repairs of the present rendezvous, and it will be a necessary step on the successful completion of a Break-water, to make a suitable enlargement of this establishment; Government should early consider the propriety of such an alteration. Plymouth, if it is determined upon, has sufficient capability.

Any similarity between this Break-water and that attempted at Cherburgh, Mr. Moye controverts; there is no back or land-water at Cherburgh, and therefore no mud or salt. Plymouth is more exposed, and has its Break-water within land: the mole of Cherburgh, on the contrary, is rather without the points of land which form that harbour, and permits the tide to pass in at one end and out of the other. From these important variations, the arguments to be deduced from Cherburgh will not apply to Plymouth.

Mr. Moyle earnestly presses upon Government that four out of six of our Dock-yards are already much injured, and will certainly be eventually ruined by the deposition of mud. Plymouth has itself felt it, though slightly, in comparison with the others. The effects of the intended Break-water are much to be dreaded in this point of view—the deposition will certainly take place in the smooth water, and it is apprehended to such a degree that "a very ingenious and scientific naval character observed, that Messrs. Rennie and Whidbey's plan would, in his opinion, obtain the premium, if such had been offered, for *the best plan of destroying the Sound*, leaving, at the same time, an opening for small craft."

The internal alteration of the harbour removes the objections made by Messrs. Rennie and Whidbey to shutting up Bam Pool, and may be attended with the additional advantage of removing the mud-banks near the Dock-yard and Crimble Ferry.

Mr. Moyle coincides nearly with Messrs. Rennie and Whidbey, in the outline of the section of the Break-water.

By finishing upon the Panther-Rock, Mr. Moyle carries the Western end of his Break-water farther to the South than Messrs. Rennie and Whidbey, and he states certain situations where the passage of ships into and out of the Break-water might be facilitated by so doing.

Mr. Moyle concludes by stating his reasons to be public ones for submitting his plan to the Admiralty and complains that it did not receive an unprejudiced investigation; he was promised "a disinterested jury of engineers," and that the proposers and abettors of the plan he condemned, Messrs. Rennie, Whidbey, and others, were placed in judgment upon him! He had no means of examining the validity of their reasons, or of replying to their assertions, for their report was never submitted to him. This, he conceives, was not that impartial consideration which, as an individual, he might reasonably expect, or the public had a right to demand.

Observations.—The controul which every well-regulated government exercises over its expenditure, is productive of the most beneficial effects, it induces a spirit of inquiry into the probable effects of things, before the actual commencement, and defers the execution of a proposition until the evidence of its necessity is satisfactorily made out.

We believe that no country is under greater obligations to this cautious policy than our own. The Houses of Parliament rarely fail to exercise it, and generally demand the clearest proofs of the existence of a want, before they will hear of a remedy. The propriety of this care is very evident; its importance increases with the magnitude of the proposed expense, and the benefit or injury it may produce to the country. We should have therefore expected that, previous to the undertaking of a work never equalled in cost and consequences by any in this country, this prudent examination, and salutary conviction, would not have been overlooked. That it has been so we cannot from our own knowledge assert, but it is remarkable that, in the documents published by order of the House of Commons, there is not a word of evidence that an erection, so prodigious in its extent, and problematical in its effects, was at all necessary. The proceedings appear to have been begun by the Earl of St. Vincent, but it is not said whether his Lordship's attention was awakened by his official duties, or by previous observation in his professional career. No reports of any actual damage incurred by the exposed state of the Sound are given, nor is any opinion stated by experienced nautical men as to the causes in which its protection might

be most necessary, or how it could be most advantageously afforded.

The previous history of the harbour, and the experience of every man who knew it, should have been consulted, and all the important facts preserved and reported. If these were obtained, what reason could there be for withholding them from the public? if they really were not procured, we cannot sufficiently condemn the indolence and precipitancy of those who began such a work without them.

The great importance to every maritime country of accessible and secure harbours, is self-evident. If proofs were desired, a comparison of the naval history of this country with that of France would furnish ample evidence—One of the greatest causes of our national pre-eminence is, that nature has scooped out the shores of this country into harbours, numerous and convenient, while she has denied almost the possibility of constructing them to her great rival. During the greater part of the last century, this superiority was severely felt by the French ministry, and at the close of a war in which it was peculiarly evident, they determined upon an effort to counteract it. The stupendous project of the Mole of Cherburgh was the consequence—a work truly admirable for the grandeur of its aim, and the science displayed in its construction.

Mons. Decessart, the Chief Engineer on that occasion, has given a description of it, and we do not know which demands the greatest eulogy, the ingenuity and boldness of the design, or the intrepidity and precision of the execution; both will claim and secure for him the admiration of posterity.

The failure of so great a work should lead others to avoid precipitation in adopting or altering designs of similar undertakings.—The great length of time necessary for the completion of this work exhausted the energies of the government—an alteration of the plan was proposed—was adopted—and Cherburgh, the hope of maritime France, was ruined, until the enterprising spirit of the late Ruler of France completed another attempt in August 1813. The history and effects of which we hope to lay before our readers. These exertions to obtain a roadstead, should stimulate this country to the most careful preservation of those she possesses. Nothing should be spared, that the ingenuity of man could suggest, or the wealth of the country procure. The combined interest of the nation should be consulted, information should be collected from every source, and no doubtful scheme attempted without the most material deliberation.

The conduct of France on this point is well deserving of imitation in this country. The establishment of the late "Corps Imperial des Ponts et Chausees," brought together the most ce-

cebrated men in the profession; emulation was excited, and the advantage of mutual communication strongly felt. The depots of this, and some similar institutions, contain models and descriptions of every work of importance throughout France. To the student and the practical engineer, such a magazine is incalculable. We lament that the public spirit of this country is not more directed to these objects: it might then be reasonably expected that a science peculiarly adapted to the genius and exigencies of England, would be generally and successfully cultivated. That it is not very extensively studied at present is certain, and may be argued from the fact that, in the great speculation now under consideration (which has no precedent from which any conclusion can be drawn.) Government selected one engineer only, Mr. Rennie, and actually confided to him the expenditure of the enormous sum of *one million one hundred and seventy-one thousand pounds!* and the *fate of the finest port and roadstead in Great Britain!* At a time, too, when Mr. Rennie's attention was divided, and continued to be divided, by the direction of some of the most important works in the kingdom. This selection is certainly highly honourable to Mr. Rennie, but conveys a reflection either upon the Government, or the state of the science among its professors.

The policy of France, in the similar design of Cherburgh, was remarkably different. That project was submitted by the minister of the day to some of the most scientific and experienced men of the nation. When sanctioned by their approbation, Monsieur Decessart was appointed Director of the Works, assisted by *four* other engineers, and *three* students. A permanent committee, consisting of members of the government, of the navy, and of the engineers, sat alternately at Cherburgh and Paris during the execution; and a previous experiment, to ascertain the probability of success, was also ordered at Havre.

In all great and national speculations, this liberal provision of talent is highly praise-worthy; it divides the weight of responsibility, and lessens the risk of failure—a school of the best experience is formed, and its instructions are not confined to a single undertaking—their beneficial influence is felt through the country, and the elevation of the national character is the result.

Much as we could wish the government had acted from these enlarged views, we feel bound to say that this wish does not arise from any unworthy consideration of the gentleman appointed. The long experience, and high character of Mr. Rennie, have raised him to the head of his profession: his numerous engagements prove the estimation in which his abilities are held; and he is, in our opinion, the most proper person for the direction of the whole. The great age of Mr. Jessop has, perhaps, unfitted

his only competitor. Of Mr. Whidbey, who reports with Mr. Rennie, we have heard nothing, except as an officer in the Dock-yard, at Woolwich.

We are somewhat surprised that Government has so narrowed its inquiries in those quarters where it might naturally have commanded information. The Navy and Transport Boards, with their surveyors, might have been advantageously consulted. The Trinity House, too, possesses many members, eminent for their skill in hydraulic architecture, though their professional adviser, being a civil architect merely, may be supposed to have little judgment in works of this description.

The probable utility of the Break-water would seem very evident upon the inspection of the map. The rolling-in of the sea in all southerly winds must necessarily be very great, and to check its impetuosity, without creating a counter-balancing evil, would the therefore a desideratum. That it has been found of sufficient importance to devote the very large expenditure intended, we must take for granted, from the want of all evidence.

The position of the Break-water is a point of great importance, and the determination of it forms the principal difference in the designs of Mr. Rennie and Mr. Moyle. Much of the good or evil effects of the proposition will depend upon the situation having been judiciously chosen. Mr. Rennie places his great Break-water across the Sound, in a direction nearly at right angles to a line drawn from Plymouth through the middle of the Sound—it is insulated, and therefore has an opening at each end.

Mr. Moyle's begins on the eastern shore, at a considerable distance from the mouth, and stretching across the Sound diagonally towards the sea, leaves an opening on the western side only.

With great submission to the authority we controvert, we think that Mr. Moyle's line is the preferable one. The Sound is more perfectly protected from the swell by the mole being continued on to the eastern shore—Standing very obliquely to the direction of the entering waves, all that strike it will be reflected from the entrance, and their direct force be considerably diminished. Mr. Rennie's receives the strokes of the sea nearly at right angles, and the inclination of the ends will have the tendency to direct the ocean into the entrances—the current sweeping in its course every part of the Sound, and pouring its entire volume through Cawsand Bay, by means of the easy and natural line of Mr. Moyle, will be more beneficial than the divided current and partial dead water of the other. Eddies of considerable magnitude may probably be made every flood and ebb by the

latter, while their formation seems to be nearly impossible by the former.

The scour over the whole anchorage in harbours like Plymouth is imperiously necessary. The deposition of mud during the dead water of tides and calm weather, is generally considerable, and cannot be so completely removed as by the action of a forcible current. Mr. Rennie very judiciously recommends that the natural reservoirs, which pour out this current should never be diminished, and his recommendations deserve the most serious attention. The influence of the great is never more perniciously executed, than in thus increasing their domains by encroachments upon the most valuable property of the public.

The back-water, &c. of Plymouth, Mr. Moyle proposes to carry in one undiminished current over every part of the anchorage in the Sound and Cawsand Bay. Mr. Rennie has divided it, and by so doing, a considerable part of the harbour has little or no current. It is here we fear a deposition. Mr. Rennie himself admits the probability of it, but considers it can never be sufficiently extensive to injure the roadstead.

The area enclosed by these two designs is nearly the same; but the estimates of its capability are widely different. Mr. Rennie states that 50 vessels of the line may be anchored securely within it. The master attendants, Jackson and Brown, are much below this, the first states 36, and the last 30 only. Whether this smallest number be large enough to justify the required expenditure we are not able to judge.—If it be correct it is a very considerable diminution of the advantage originally expected to be derived from the Break-water.

The external slope of this immense bank, we conceive should be very great. Mr. Rennie proposes it should be in the proportion of three horizontal to one perpendicular. Mr. Moyle's is still steeper. Both are too much so. Nature should be consulted; her operations, in similar cases, furnish an unerring rule. Shores formed of the lightest materials have a permanent solidity by the small degree of inclination which is given to them.

The slope of the sides of the Mole at Cherburgh was originally the same, or nearly, as that adopted by Mr. Rennie; but Mons. De Curt, in his Report on that subject to the National Convention, states that the sea had corrected the error, and fixed the proportions at about eight or ten to one—and that with this inclination the waves had ceased to have any effect upon the Mole. As the blocks of stone at Plymouth will probably be much larger than those used at Cherburgh, a slope of five or six to one would, perhaps, be sufficient. With a less slope the Pier at Aberdeen, composed of very heavy stones, we understand, has been partly destroyed. As the form of this Break-water, and the weight of the stones of which it is composed are the only securities against the

violence of the sea, they become of the last importance; the effect of a breach would be the dispersion of the stones over the Sound; and, consequently, the total ruin of the harbour.

The hints thrown out, p. 198, of our first Volume, of the extraordinary service which the polypi of some countries might render to works of this nature, may lead us to search if no animal or vegetable can be found in our northern latitudes, which, by its incrustations or embraces might bind the unconnected materials firmly together. In situations where the hand of man cannot arrange the component parts, or unite them by cement, such a discovery would be invaluable.

The objection urged by Mr. Moyle, that the difficulty of entering the Sound against tide will be increased by Mr. Rennie's design, applies equally, or more so, to his own, and is unavoidable.

In stating the relative position of the Break-water, at Cherburgh, Mr. Moyle describes it as "rather without the two points which constitute the harbour," it is certainly within the points he has named.

With regard to the interior harbour, we are disposed to think that Mr. Moyle has suggested a real improvement in the straight cut proposed from the Sound to Hamoaze, if a local survey present no other difficulties.

The propositions of Mr. Bentham are of a very different character to any of the others. They appear the bold conceptions of a mind enterprising and original, but which over-looks the innumerable difficulties of practical execution. This is remarkable, as the years and experience of Mr. Bentham would have been sufficient in most cases to have enabled the possessor to detect the delusions of theory. With these qualifications of Mr. B. in our recollection, we cannot with-hold our censure from his estimates —statements so evidently deficient, tend to continue and justify the reflection so generally made on the incompetency of similar calculations.

The first manner in which Mr. Bentham proposes to execute the Breakwater we should have thought worthy of an experiment. Its great principle is the same as that of Cherburgh, differing for the most part in the mode of constructing the masses. Had it been suggested there, and proper materials could have been procured, we think it would have been preferred. Mr. B's second design we conceive to be totally impracticable.—Enamoured of a favourite mode of construction, he permits his partiality to put out his discrimination. His idea of a Floating Break-water, in a less exposed situation, may perhaps be useful. In the place under consideration we are of opinion it would fail. Still the facility of its execution, and the total absence of all risk, either to the harbour or shipping, make it desirable that it should be determined by experiment—indeed, from a judicious trial, we think some very important practical information would be collected.

We cannot conclude without remarking, in the Plan which accompanies the House of Commons Reports, numerous omissions of many places mentioned in the text.—This is by no means a pardonable negligence.—Mr. Moyle's Plan, also, has the same defects, though it is evidently a subsequent alteration of the same plate.

Description of a Vapour, Fumigation, or Shower-Bath, adapted at a cheap expense, for Public Hospitals, or Private Families. By GEORGE CUMMING, M. D.—*Trans. Society of Arts. vol. XXX.*

This Bath is extremely simple, and may be conveniently made of any piece of cooperage, of sufficient dimensions. But nothing can perhaps answer better than a common wine-pipe, which, after being well washed, is to be sawn across, about the middle, then to be well scraped and cleaned in the inside, and afterwards placed vertically upon a frame with castors. The upper half (in the top of which an aperture has been previously prepared for the head and neck of the bather) is to be furnished with cords, pullies, and counterpoise, so that by connecting it with any beam, roof, or ceiling, it can be raised or depressed, or in other words, the Bath can be opened and shut with the greatest facility.

Upon the margin of the lower piece of the Bath there is a groove three-fourths of an inch deep, receiving the circumference of the upper half, and which is thus formed. A strong iron hoop is first put on the outside, and then well driven about half its depth, when a similar one, after being rivetted, is driven to the same depth within.

The groove thus formed is of the first importance, as it not only renders the Bath, with the assistance of a little water, steam-tight, but also effectually prevents it from undergoing any change of shape. It may also be observed, that the above hoops are so hammered or set, as to make the groove somewhat wider than the staves upon which they are applied, and that the edge of the upper or moveable piece of the Bath, is cut with a cooper's knife, so as readily to fall, or slip into it.

The boiler is distant from the Bath about six feet, and the steam-pipe is made to enter an inch above the bottom, and to extend itself horizontally to the centre of the same, when with the view of equally diffusing the heat, a piece of coarse linen or calico, stretched upon a hoop (with a notch to admit the steam tube) is placed over it. This may be called the diffuser, and is made of a less diameter than the bottom of the bath, in order that the feet of a strong frame or grating, to support the bather, may securely rest upon the bottom of the bath. Immediately over this grating, a floor of split-ash (like a sieve) is laid, and upon this a seat is

placed, which is fastened to the side of the bath, by means of a bracket. This seat serves the bather, as a step, as he goes in, or comes out, of the Bath.

To accommodate the various sizes of bathers, light frames, covered with split ash, in the manner of cane-work, may be placed upon the same seat as required.

The whole of these loose articles may be packed within the Bath, when not in use, and placed in proper order, in a few seconds, when wanted.

Doctor Cumming concludes his general description of the apparatus, by declaring that it is simple, cheap, neat, durable, and efficient, and admits of a great variety of applications.

In this opinion we perfectly concur, and think that Dr. Cumming has made an useful present to the public, in contriving this apparatus, which may enable many an invalid to employ the valuable remedy of a Vapour Bath with comparative ease and cheapness.

Mechanical Mode of destroying Rats, and other Vermin. By Mr. WILLIAM BOWLER.—*Transactions Society of Arts, Vol. XXX.*

The description of this Rat-trap inclines us to believe that it possesses ingenuity sufficient to entitle it to some commendation. But it is a fundamental objection to every instrument of this kind, which possesses the power of receiving and securing only one solitary individual of these annoying animals at a time. They should allure, and retain, if possible, a whole family, a whole race of vermin. And we believe contrivances are not wanting, which receive and retain all comers, and either preserve them alive in a space, separated from the bait and other parts of the apparatus, or precipitate them into a vessel of water prepared for this purpose.

An improved Machine, to enable Shoe and Boot-makers, to Work without Pressure upon the Breast or Stomach.—By Mr. I. KING.—*Trans. Society of Arts. Vol. XXX.*

This machine consists of an oblong frame of wood of two sides, with cross pieces. It may be conveniently fixed in a situation, and at a proper height for working, by screwing down to a window-cill, by means of two screws, such as are used for bedsteads. These, and an iron bracket, extending from the front of the machine, being screwed against the wainscot, support the machine very steadily; or a stand, consisting of proper legs, may be used, if preferred. The external parts of the machine are covered with leather, so as to become like cushions to support the last, and it is held down by a strap, which has a loop or

treadle at the bottom, for the foot. The principal novelty of this invention consists in a lever, which is attached by an iron link to a wire, upon which it moves as a centre; and when that is down in its place, a small point or beak of iron, enters into holes made in an iron plate; and the other end of the lever comes to rest on a stop, which has several holes in it. The end of the lever has, also, a little iron beak, which enters these holes. Thus, when the lever is down, it becomes an immoveable cross-bar of the frame, and the last may be held or wedged in between this, and either slide of the frame, and held down by the strap. But to adjust the width of the opening, on which the last lies nothing more is necesear y than to lift up the lever, so that the point clears the holes of the plate, then sliding the link along the wire, to the intended width, and shutting it down again, the beak or point, enters some other hole of the plate, and holds the lever fast in the new position, so as to adapt it to the width of any last, or to hold it in any position, at pleasure.

Mr. King observes that, at other times, the last is held down by the foot-strap pressing the lever upon it—that the machine forms an universal vice, supporting and holding the last firmly down upon the cross-bar, in any required position. Two stiff pieces of sole-leather are also fixed in the frame, which, in certain positions, supports the last.

Observations.—If confidence is to be placed in the certificate of a long list of individuals, who have used Mr. King's machine, and who state that it is highly conducive to the health of Boot and Shoe-makers, Mr. King will, doubtless, be speedily gratified in witnessing its general adoption by that numerous class of the community; but we fear that the liberality of the Society in rewarding Individuals for inventions of a similar nature, has not yet led to their general adoption.

On the Cause of audible Sound in vibrating Strings, Tuning Forks, &c. On the Use of Hawkin's Mouth-tuning Forks; on Earl Stanhope's proposed Steel Piano Forte Strings, &c. *Phil. Mag. Jan.* 1812.

If the writer of this article wished to convey the idea that Mr. Gough has discovered any thing new by the experiment which he mentions, we conceive that he is mistaken, as every writer on the laws relating to sound, and sounding bodies, establishes every principle which he states, by enlarging on the reverberation of the pulses of the air from all the sounding bodies against which they strike, and on the increased effect of the tone, thus produced. His observations, however, respecting the formation of the common Tuning-fork, and the Mouth Tuning Fork, invented and sold by Mr. I. Hawkins, are more worthy of attention.

A Compensation Pendulum, to prevent the Rate of a Clock from varying by Heat or Cold. By Mr. DAVID RITCHIE *—Trans. Society of Arts. Vol. XXX.*

THIS Compensation Pendulum has only one steel rod, with two short compound bars of brass and steel, placed near the ball, at right angles to the pendulum rod; and the bars, being parallel, admit of perfect adjustments without altering the rate of the clock. A simple contrivance is also introduced between the compound bore which takes off the weight of the ball, and leaves them at liberty to contract or expand, free from every incumbrance. The compound bars may be reduced to the size of the pendulum rod, and will be equally affected by heat and cold. It is free from friction. It has some advantages over the mercurial pendulum, in being portable, and not liable to be deranged. It may be applied to the smallest table clock, or the largest turret. It is likely to be of great public utility, and can be afforded for less than half the expense of the most approved pendulums.

Observations.—Various remarks, respecting the pendulums invented by Messrs. Harrison, Ellicot, &c. accompany the above statement, displaying their apprehended imperfections and defects. These instruments have, however, been so long established in the opinion of proper judges, that a due degree of trial must be had to supersede them by any new invention.

On the Change which Alcohol and Spirituous Liquors undergo by Rectification with alkaline, saline, and earthy Substances; with an improved Mode of obtaining perfectly pure Spirit of Wine. By M. DUBUC.*—Ann. Chim. Tom.* 86.

THE strongest and lightest alcohol that can be obtained by simple distillation, is that which is marked at about 40° of Beaume's areometer at a medium temperature, which corresponds to about .827 specific gravity. This is procured by rectifying good alcohol at a very gentle heat, and taking only the first portion that comes over. An alcohol of much greater levity may be prepared, by distilling the spirit with certain saline and other additions; but it is the object of M. Dubuc's experiments, to shew that all these additions in some slight degree alter the chemical properties of the alcohol distilled from them, a minute portion even of the most fixed of these substances being volatilized along with the vapour of the heated spirit, and shewing itself in the condensed spirit by the usual chemical tests.

The following substances have been employed by different chemists, viz. the two fixed alkalies; muriate of lime; muriate of potash; quicklime; calcined gypsum; dried sulphate of soda; and, lately, melted acetite of potash. The author has examined each of these experimentally.

Pure alcohol of 40° (hydrometer) gains three or four degrees of levity by rectification with potash or soda, either entirely caustic, or partly carbonated, but it becomes thereby of more subtile smell, and loses its natural sweetness; it turns syrup of violets green, and copiously precipitates spring water containing sulphate of lime.

Pure alcohol, rectified over the muriates of lime and potash slightly calcined, becomes still lighter than in the last experiment, but it also acquires a hot bitter acrid taste, and gives indications of containing a portion of these salts by the tests of ammonia, nitrate of mercury and silver, &c. Quicklime, grossly powdered and mixed with pure alcohol, heats it so much, that a portion will distil over without any fire, but even this portion gives some signs of alcalescence when shaken with a watery infusion of the Avignon berry. On proceeding with the distillation at a gentle heat the spirit becomes more acrid, and is immediately troubled by water holding carbonic acid, from which, after remaining at rest for two days, a sensible quantity of carbonate of lime may be collected.

Pure alcohol, distilled from calcined gypsum, acquires greater levity than before, but at the same time contracts a peculiar and disagreeable smell, renders turbid the red colour of infusion of field poppy flowers, (which is heightened by pure alcohol) and gives a dingy shade to tincture of violets, circumstances that shew the presence of some extraneous matter in the spirit.

Calcined Glauber's salt, fully freed from its water of crystallization, appears to be an excellent medium for bringing alcohol to a high degree of dephlegmation, and in fact it is found to answer this purpose extremely well. Nevertheless, alcohol, so prepared, is rendered slightly turbid by barytes, and thus shews the presence of a minute portion of the sulphate of soda employed in the process. The smell of this alcohol, however, is highly fragrant. Two parts of the spirit may be used to one of the salt.

Dried aceiite of potash has been lately used by an intelligent apothecary of Paris, and it succeeds beyond all expectation in bringing the spirit to a very high degree of levity. But it is very materially changed in its sensible and chemical properties, having acquired a very pungent taste like the pharmaceutical tincture of tartar, an acrid saponaceous bitterish taste, and having the property of rendering the infusion of violets green.

It has been also proposed to dephlegmate alcohol of 36 degrees by distillation in a water-bath, with a small proportion of sulphuric acid, such as $\frac{1}{16}$ of its weight. M. Dubuc observes, that as long as the spirit thus rectified does not exceed 38 degrees, it retains all its properties unaltered; but beyond this degree, it acquires a fragrant etherial smell, which shews a commencement of further chemical change, and an approach to the character of sulphuric ether.

Common alum, from the great quantity of moisture which it loses on calcination, would appear highly proper for the rectification of alcohol. The author tried the experiment of distilling alcohol of 36 degrees from half its weight of calcined alum. The product was a fragrant alcohol of 39 degrees, but it had now acquired the property of reddening litmus. It was three times successively redistilled from fresh calcined alum, but the strength of the spirit still remained at 39 degrees, and it still gave the marks of an acid by reddening litmus. Hence it appears, that the alum only abstracts that portion of water which may be considered as extraneous to the pure alcohol; and in the process, a minute portion of this acidulous salt is volatilized, and appears in the distilled spirit. This is shewn by reddening litmus, and also by its rendering barytic water turbid, which points out the acid to be the sulphuric.

The author also rectified alcohol over decrepitated common salt, but the strength of the spirit could never be got beyond 36° and in the distillation, so much of the salt rose along with the vapour of the spirit, as to be made very sensible in the condensed product, by the tests of nitrate of mercury or silver.

Finding that every saline substance, even those that are considered as the most fixed, is in some degree volatilized by the vapour of alcohol (and indeed by the vapour of boiling water) the author was led to try two other substances for the dephlegmation of spirit of wine, both having a strong affinity for water, and apparently having no action on the purely spirituous element. One of these was charcoal, and the other clay. Alcohol, of 36 degrees, was mixed in a bottle with fresh beech charcoal, well bruised, and still warm from the fire. They were often shaken together during four days, after which the spirit was filtered off. No change of specific gravity was found, nor was any material alteration produced by distillation, but the smell of the spirit was more fragrant than before. The charcoal of other woods produced the same effect. Hence it appears, that charcoal absorbs the spirituous portion of spirit of wine with as much force as the watery part, and therefore that it is of no other use than probably to deprive

the spirit of any unpleasant smell which it may have acquired from the fermenting materials from which it is prepared.

One litre (about a quart) of alcohol, of 36 degrees, was mixed with eight ounces of pure well-dried alumine, artificially prepared. After two days of mixture, the spirit was carefully decanted off and distilled to dryness in a water-bath. It shewed 40 degrees before distillation, and 41 degrees afterwards, and it then had acquired a very pungent disagreeable taste. The alumine was then strongly heated to dry it, and the alcohol was redistilled from it, by which it rose to 42 degrees, which is equal to 8,292 specific gravity. This alcohol has all the properties of good and perfectly pure spirit, and no reagent shews the presence of any foreign matter whatever. This specific gravity of 42 degrees, or 8,292, is the highest point of levity to which the alcohol can be brought by any number of rectifications from alumine.

Common porcelain clay, well washed, sifted and dried, will answer equally well with alumine artificially procured, only about a third more of the clay is required than of the alumine.

The author proposes this process (which he believes to be original) to chemists, as affording a method of preparing a very pure and highly rectified alcohol, which in no respect differs from pure spirit, of an inferior strength, except by the abstraction of water. Whereas all the most highly rectified alcohols, prepared with saline substances, are more or less changed in their constituent principles, and therefore will not return to their original state of weaker rectified spirit, by the mere addition of water.

In the valuable experiments of Lavoisier and Saussure, on the analysis of alcohol, these eminent chemists have considered pure alcohol as identically the same from whatever fermented liquor it has been prepared. It is possible that this may be the case, but M. Dubuc affirms, that in a long series of experiments on the distillation and rectification of alcohol, he has invariably remarked, that whether the spirits are rectified by mere distillation, or by the addition of charcoal, they always betray, by their peculiar odour, the origin whence they have been derived; so that the alcohol from brandy, rum, cyder, perry, &c. may always be distinguished from each other, if rubbed on the hands, diluted with warm water, or mixed with a little sulphuric acid, by which the characteristic smell and taste are evolved. On the other hand, when the alcohol is brought to extreme levity by the intermede of saline substances, the peculiar fermentible origin of the spirit is no longer distinguishable; but then, as the author asserts, the spirit has undergone a certain degree of *etherification*, and even certain species of alcohol of equal specific gravity with others, will afford a much greater proportion of ether when distilled with sulphuric

acid, which would give weight to the opinion of an original difference in the constitution of alcohol, according to the source whence it is derived.

Observations.—This memoir of M. Dubuc's is highly valuable, as being obviously the result of long practical knowledge, and we only wish that the author had been still more minute in the practical part, as his experience of twenty-five years must have furnished him with many valuable particulars on this important subject. It may still, however, be questioned, whether any other change takes place in the distillation of highly rectified alcohol from saline substances beyond that of containing a very minute portion of the saline matter carried up by the vapour of the spirit. It is obvious that the alcohol appears to exert no peculiar affinity to one saline body over another under these circumstances, since where an alkali is used, the spirit is alkaline; where an acidulous salt, (such as alum) is employed, the spirit has an excess of acid; where a muriate is used, the spirit shews the presence of muriatic acid, and the like. It remains for further experiments to determine, whether all these varieties of alcohol are essentially different in their proportions of hydrogen oxygen and carbon; or whether they are only one and the same spirit, holding in solution the peculiar saline substances employed for its rectification. The only method of determining this point, would be to analyze each alcohol by combustion with oxygen in one form or another, and carefully to estimate the products. This has been partly done by Th. de Saussure, in his experiments related in the Journ. de Physique Tom. 64. His strongest alcohol had the specific gravity of only 0.792 at 68° Fahr. and was obtained by distilling spirit of wine from half its weight of muriate of lime, dried nearly at a red heat, and drawing off only half the liquor, which last was again distilled from its own weight of muriate of lime, and only the first half of the product taken. M. de Saussure, after analyzing this highly rectified alcohol by combustion, performed the same experiment on common alcohol, rectified by distillation without addition, and after making due allowance for the proportion of water allowed to be contained in it by Richter's tables, the purely alcoholic part hardly differed in composition from the alcohol rectified by muriate of lime, and therefore the latter had not acquired any of the properties of ether by this mode of rectification.

M. Dubuc's method of rectification, by means of dried clay here related, may perhaps be more extensively employed where a very pure spirit of considerable strength is wanted.

Extract of a Memoir on the Existence of Alcohol in Wine. By M. Gay-Lussac.—*Ann. Chim. Tom.* 86.

In this memoir, it appears that this excellent chemist has been exactly following the steps of Mr. Brand, in ascertaining the long disputed point, whether alcohol exists, as such, in wine and other fermented liquors, or whether it is actually formed during the process of distillation. We mentioned in a former number, (Vol. 7, p. 354.) Mr. Brande's first experiments, to which we shall refer our readers, and we have just been giving his subsequent ones, in which he has succeeded in separating the spirit from wine without distillation, by means of carbonate of potash, assisted by sub-acetite of lead to separate the extractive matter; which, when not thus removed, unites with the alkali into a saponaceous mass, and prevents the appearance of the spirit.

Observations.—It is a little singular that M. Gay-Lussac should have hit upon almost exactly the same method as Mr. Brande employs, for he recommends shaking the wine with finely pulverized litharge, which soon becomes as limpid as water, after which the simple addition of subcarbonate of potash will separate the alcohol from the wine, without any other process. Another proof of the presence of alcohol in wine, given by M. Gay-Lussac, is to distil it in vacuo at the temperature of 60° Fahr. which is lower than that produced by the vinous fermentation, when a true alcohol will be obtained.

Chemical Examination of two Varieties of Arsenical Cobalt, followed by Experiments on the Nature of the Sulphurets of Arsenic, and the Arseniates of Barytes and Lime. By M. Laugier.—*Ann. Chim. Tom.* 85.

Mineralogists have distinguished two varieties of arsenical cobalt, namely, the blackish grey, and the white speiscobalt. The examination of each of these two specimens, which forms the first part of this memoir, was thus conducted. A hundred parts of the ore was digested with pure nitric acid, more than sufficient for its solution, and a grey insoluble residue was left, which, when afterwards fused with caustic potash, gave all the characters of silex. Into the nitric solution was poured drop by drop a solution of supercarbonated potash, as long as it gave a yellowish white precipitate, and the addition of the alkali was discontinued the moment that the precipitate was rose-coloured. An excess of acid was then added to the filtered solution, and a current of sulphuretted hydrogen was passed through, which caused much yellow sulphuret

of arsenic to separate. After 24 hour's rest, the sulphuretted hydrogen was again repeated, and afterwards a third time, so as completely to decompose the arseniate of the solution, and separate the arsenic as yellow sulphuret. The remaining clear liquor was then heated to expel the adhering sulphuretted gas, and afterwards saturated with caustic potash, which gave a blue precipitate. This last was then washed with boiling water, and whilst still moist, was treated with an excess of oxalic acid, (the mode of separating iron and cobalt used by M. Tupputi) which forms an insoluble light rose-coloured salt with the oxyd of cobalt, whilst the yellow oxalate of iron dissolves in an excess of the same acid. The oxalate of cobalt, when calcined, left the pure oxyd of cobalt; and the oxyd of iron recovered by caustic alkali from the oxalic solution, and added to the portion first obtained by the supercarbonate of potash gave the whole of this metal contained in the specimen. The most imperfect process in this analysis, is the determination of the arsenic from the weight of the yellow sulphuret of arsenic produced in the way above-mentioned. When this yellow sulphuret is slowly dried at a gentle heat, till it just fuses, it loses some sulphuretted hydrogen, and then becomes an opake yellow mass, which the author considers as identical with native orpiment, the composition of which the author endeavours to determine in a subsequent part of this paper.

A second mode of essaying the arsenical cobalt ores, with a view of finding the arsenic, was to distill each specimen with twice its weight of iron filings in a coated glass retort, by which the arsenic was expelled in a metallic state.

A third method of finding the arsenic was, to fuse the ore with caustic potash, which extracts this metal more completely than by the former way, though at the same time it also takes up any silex and sulphur which it may contain. The oxyds of iron and cobalt are untouched by the alkali, which may be afterwards separated from any remaining silex, by nitric acid, and from each other, by the oxalic acid.

The chief difference in the two species of arsenical cobalt-ore here analyzed, was found to be a much larger proportion of silex, and much less arsenic in the grey variety than in the white.

The author then proceeds to relate his experiments on the compounds of arsenic and sulphur. Two of these have generally been admitted, namely, orpement and realgar, the former yellow, the latter red. The first conjecture, as to the chemical difference between these two species, was to suppose the presence of oxygen in one and not in the other; but Proust has satisfactorily shewn that in all the metallic sulphurets, the metal is in the reguline state, and

consequently no oxygen can be allowed as a regular ingredient of any of these compounds.

M. Thenard, in an interesting memoir published in the Annales de Chimie, has found a notable difference in the proportion of sulphur in orpiment and realgar, to which he attributes the distinct characters of these two substances, the former containing 43 to 45 parts per cent. of sulphur, and the latter only 25. The accuracy of this determination has however lately been called in question by Haüy, on the ground of the identity in the form of the crystals of these two compounds, whence he infers the same identity in their chemical composition.

The experiments of Mr. Laugier, the author of the present paper, go to establish a still different result, though they are confessedly imperfect. The analysis of all the sulphurets is difficult, and that of the sulphurets of arsenic would be almost impracticable, if the estimation of each of the two ingredients by direct experiment were indispensible; but as these sulphurets only contain sulphur and arsenic, and as the proportion of sulphur may be found with pretty great accuracy, that of the arsenic may safely be inferred, as it cannot well be found by any experiment. In this mode of proceeding, the sulphuret must be digested in a retort with pure nitric acid, diluted with twice its weight of water till it is perfectly dissolved. A heat short of ebullition is preferable, and at least twelve hours of digestion are required. The sulphurets gradually dissolve into a clear dense liquid, and this takes place the sooner when the sulphuret is compact, than when it is light and lamellar. The dense liquid thus formed is a mixture of sulphuric and arsenic acid, which must be diluted with water and nitrate of barytes added as long as any precipitate forms; and the whole must then be boiled, and allowed to remain at rest. The precipitate is sulphate of barytes, the arseniate of barytes remaining dissolved in the excess of acid. Estimating the sulphate of barytes from the proportions given by Berzelius, 100 of the sulphate contain 34 of sulphuric acid; and 100 of sulphuric acid contain 40.53 of sulphur; or in other words, 100 of sulphate of barytes contain 13.8 of sulphur. Sometimes a part of the arsenic refuses to dissolve by the first digestion, but remains at the bottom of the vessel in small brilliant crystals of arsenic oxyd. In these cases these crystals must be taken out, and digested separately in fresh nitric acid to be dissolved.

The author then mixed together four separate porportions of arsenic and sulphur namely:

1st. 200 of arsenic with 100 of sulphur.
2d. 200 of arsenic with 150 of sulphur.
3d. 200 of arsenic with 200 of sulphur.
4th. 200 of arsenic with 400 of sulphur.

The arsenic was in its purest reguline state, being reduced from the white oxyd by soap and twice sublimed. Each of these mixtures was heated separately in a glass retort to a moderate degree. It became brown, puffy, melted, and then partly sublimed in the neck of the vessel as a reddish brown layer, easily detached.

A hundred parts of this brown sublimate from each mixture were then digested with nitric acid, and precipitated by nitrate of barytes in the way above described. The resulting sulphate of barytes was 302 parts from the first mixture, 304 from the second, and 304 from the third; indicating respectively 41.39, 41.8 and 41.8 parts of sulphur, which are so nearly the same, as to be almost identical with each other. The fourth mixture gave only 267 parts of sulphate of barytes; but 12 parts of sulphur remained undissolved in the nitric acid, which, added to the sulphur of the barytic sulphate would give 41.8 parts of sulphur as in the others.

In the distillation of the first mixture in which the arsenic was in considerable excess, a portion of this metal sublimed separately and distinct from the brown-red sulphuret of arsenic which was analyzed. On the other hand in the fourth mixture, in which the sulphur predominated, the sulphuret instead of rising in the retort remained adhering to the bottom, and containing some sulphur, entangled as it were in the sulphuret and altering its purity.

When the sulphur and arsenic were mixed together in the exact proportions of the red sulphuret, that is, about 110 of arsenic, and 150 of sulphur, the layers of red sulphuret were more brilliant and perfectly transparent.

A specimen of very fine orange-coloured realgar, sold under the name of *Golden Sulphur*, was also analyzed by nitric acid in the way above-mentioned, and gave nearly the same proportion of sulphur as the preceeding mixtures, that is, about 43.82 per cent.

100 parts of the sulphuret of arsenic made in the moist way were dried moderately and then melted, during which some sulphuretted hydrogen gas escaped, and 90 parts of a red-brown sulphuret remained, which on further analysis with nitric acid gave also nearly the same proportion of sulphur as all the other specimens, being in this case about 40.9 per cent.

The artificial red sulphurets of arsenic being analyzed, the author proceeded to the examination of the native sulphurets, both red and yellow, or native realgar, and native orpiment.

100 parts of beautiful, translucid, golden coloured native Orpiment analyzed by nitric acid and nitrate of barytes gave 38.14 per cent. sulphur, which was the same in three successive trials. A portion of the same orpiment, heated to fusion in a glass tube,

gave no sensible quantity of moisture, but there sublimed a number of brilliant white crystals of oxyd of arsenic, leaving beneath them a red sulphuret, which was *now* exactly similar to all the artificial red sulphurets above mentioned, and shewed 41.8 per cent. of sulphur when analyzed by nitric acid and nitrate of barytes. Native orpiment therefore appears to differ from the artificial red sulphuret only in containing a small excess of oxyd of arsenic.

Perfectly pure native Realgar, unmixed with other substances is extremely rare; that procured from Kapnich, in Transylvania, is the only species which crystallises in a regular manner. It has a very beautiful orange yellow colour, and when in fine powder it adheres to and stains every substance which it touches. It becomes remarkably electric by friction. Some of this rare mineral was given to the author by M. Haüy for analysis, and 100 parts treated by nitric acid and nitrate of barytes gave only 30.43 per cent. of sulphur. Two other specimens of realgar from China, and asserted to be native, gave 31.65 per cent. of sulphur, which nearly approaches to the composition of the native crystallised realgar from Kapnic.

The author concludes this interesting paper by some analytical experiments on two salts but little known, the arseniate of barytes and arseniate of lime.

The arseniate of barytes prepared by the direct combination of arsenic acid and barytes was dissolved in water, leaving a slight excess of the acid. The precipitate of arseniate of barytes was well washed and ignited, and 100 parts were then dissolved in nitric acid, and dilute sulphuric acid was added drop by drop as long as any sulphate of barytes deposited. After twelve hours rest this precipitate was collected, washed, and ignited, and its weight was exactly 100 parts, or the same as the arseniate of barytes employed. A similar experiment with sulphate of potash, instead of sulphuric acid, gave exactly the same result. It appears therefore that the sulphuric acid unites with barytes in precisely the same proportion as the arsenic. The supernatant liquid in the former experiment contains the nitric arsenic, and a small excess of sulphuric acid. The former readily escapes during evaporation, and it would appear an easy matter to separate the two latter by heat, the arsenic acid being singly fixed in the fire, and the sulphuric being volatile. But it was found on trial that this mode of separation was impracticable, for the sulphuric acid flying off carries with it a portion of the arsenic acid.

Arseniate of barytes dissolved in acids is not compleatly separated by alkalies, as a portion remains in solution, forming a triple salt of arsenic acid, barytes, and the alkali used.

Arseniate of lime was also examined, and this salt was formed also by the direct combination of its ingredients. A hundred

parts of ignited arseniate of lime were dissolved in nitric acid, an excess of potash was added, and which caused the precipitation of many flocculi of the arseniate of lime, after which oxalate of ammonia was poured in, and the whole was heated. The first flocculi were redissolved and were succeeded by a copious deposition of oxalate of lime; this latter salt when collected, washed, and strongly calcined left 31 parts of pure lime, which dissolved in nitric acid without effervescence. The 100 parts of arseniate of lime therefore contain 31 of lime, and the remainder is arsenic acid. These quantities do not much differ from those which Klaproth has found in the *Pharmacolite*, who allows 33 per cent of lime in this mineral. Other experiments confirm in a great degree this analysis.

The general results of these interesting experiments on the habitudes of arsenic and sulphur are:

That every mixture of arsenic and sulphur heated to fusion and sublimation yields a yellowish or brownish red transparent substance, which is a sulphuret of arsenic, whose constitutent parts are always in the same proportion to each other; namely, about 42 of sulphur and 58 of arsenic, supposing the data of Berzelius to be correct, which allow 34 per cent. of sulphuric acid in sulphate of barytes, and 40.58 per cent. of sulphur in sulphuric acid.

That both the native *yellow* and *red* sulphurets of arsenic (the former, *native Orpiment*, the latter, *native Realgar*) contain a less proportion of sulphur than the last mentioned artificial compound; the native orpiment having 38 per cent. and the native realgar only 30 to 31 per cent. of sulphur. But the action of heat by driving off a portion of arsenic reduces both these mineral substances to a compound analogous to the artificial sulphurate of arsenic.

That the arseniates of barytes and lime contain the acid and the base in nearly exactly inverse proportions to each other; the arseniate of barytes having 34 per cent. of acid and 66 of barytes; and the arseniate of lime having 67 to 68 per cent. of acid, and 32 to 33 of lime, in which composition it agrees closely with the native arseniate of lime or pharmacolite.

Observations.—The experiments detailed in this paper are well worthy of notice, as they throw some light on the composition of those coloured sulphurets of arsenic which are of some importance in the arts as pigments. It still, however, does not appear certain, whether the arsenic is entirely in the reguline state in all these compounds, and whether the great variety in the shades of colour is merely owing to differences in the mere proportions of sulphur and arsenic. Some of the author's experiments in which

he obtained sublimed *oxyd* of arsenic by heating the native orpiment and realgar, would lead to the supposition that a part at least, of this metal was not reguline; but more minute experiments are required to determine this point. If it is true that the Chinese realgar is not a native, but an artificial production, this would be another valuable secret of manufacture of that ingenious people, which had not been equalled by European industry.

On the Use of Zinc, as the Material for Measures of Liquids, and for the various Vessels and Utensils required in Military Hospitals.—Ann. Chim. Tom. 86.

The use of Zinc having been proposed by some chemists and manufacturers to supply the place of copper, and thus to avoid the dangerous qualities of that metal, the Minister of the Interior submitted the question to the Institute, in January 1813, and desired a committee of able chemists to examine the subject. Those appointed were Portal, Berthollett, Deyeux, Vauquelin, and Morveau; and their Report, which forms the subject of this paper, was returned in the following month.

They begin by stating the acknowledged danger attending the habitual use of copper vessels, for domestic and other purposes, defended as it is with a coat of tin so thin that a square inch is covered with only $\frac{1}{100}$ of a grain of tin.

Several attempts have been made to supersede the use of tinned copper. The celebrated Rinman in 1779, published in the Stockholm Transactions, a method of plating iron vessels with an earthen glazing, or enamel, which should retain its adhesion to the metal during all its changes of temperature when in common use; but Rinman's method was never adopted generally, being found too difficult to execute, and to require more care to preserve the enamel from accidental injury than could be reckoned upon in common and daily use.

Mr. Wedgewood attempted a similar glazing of cast-iron vessels, but without sufficient success.

Other similar attempts having failed, the idea of a vitreous glazing was given up, and the public attention was turned to Zinc, owing to a prejudice conceived against common tinning, in which it should seem that the French manufacturers use an alloy of tin, with a third part of lead, and sometimes containing arsenic.

The Committee then relate various attempts to introduce the use of Zinc vessels, for domestic purposes, and to render it sufficiently malleable.

In 1781, it appears that M. Sage had succeeded in laminating this metal into leaves as thin as paper.

In 1783, a company was established at Nantes, for the manufacture of Zinc-plates for sheathing ships, but it was soon given up.

In 1800, M. Buschaendorf, of Leipsic, published a method of plating copper, with an alloy of three parts of Zinc, and two of tin, laid over the common tinning, which he recommends as giving a very solid and durable metal.

Some years after, M. Deiter, an assayer of Vienna, gave out that he had found the means of working Zinc into boilers, cucurbits, and other utensils.

Nearly at the same time Zinc was still more pompously recommended in England as a substitute for copper; and Messrs. Hobson and Sylvester gained the credit of rendering Zinc pure and malleable by processes long before published by Proust. (On this subject we shall make some remarks at the end of this article.)

In 1808, M. Tornu proposed to the Minister of the Interior to cover the roof of the new Bank at Paris with an alloy of his composition (we presume an alloy of Zinc) which had been partly used for this purpose on the Halle aux Bles some years before, but without any very satisfactory result.

The experiments which the Committee tried were the following:

Some distilled water was put into a Zinc vessel, and kept in digestion at a gentle heat, in a sand-bath, till three-fourths of it had evaporated. The inside of the vessel was entirely lined with a *hydrate of Zinc* possessing its usual acerb metallic flavour.

Distilled vinegar, lowered with sixteen times its quantity of water, kept for twelve hours without heating, in a Zinc vessel, formed a white rim of oxyd, and the liquid assayed with prussiate of pot-ash gave a white flocculent precipitate of prussiate of Zinc.

Cream of tartar, citric acid, and salt of sorrel speedily dissolved so much of the metal as to give a copious precipitate with potash.

Cold water, holding a twentieth part of its weight of common salt, and kept for twelve hours in a zinc vessel formed a sensible quantity of muriate of Zinc.

Even when zinc is exposed to an occasional current of water it wastes in a sensible degree, for a plate of this metal kept for 38 months on a sloping roof had lost as much weight as was equivalent to an ounce on the square toise, so that though it might with advantage supply the place of lead for plain roofing, its use in gutters, cisterns, baths, and wherever it would be constantly wetted is much more dubious.

The general results given by this committee are: That zinc when sufficiently pure to be malleable contains no arsenic, or only an infinitely small portion of this metal, and therefore that no apprehension of mischief need be entertained on this account, but that even the purest zinc is acted on in no great length of time by all saline liquids and even by water, produciug a soluble salt of this metal which has a styptic, nauseous, metallic taste, and a powerful action on the animal body. They also are of opinion that the alloys of this metal are still more oxydable and soluble than the pure zinc, and their use is attended with at least equal inconvenience.

Observations.---The experiments here given are quite decisive as to the ready solubility of zinc in most saline liquids, and its oxydability in water alone; and therefore it is obviously impracticable to introduce this metal as a substitute for tin or pewter for common uses.

Lately Messrs. Hobson and Sylvester have succeeded in making zinc perfectly malleable by the simple method of heating it somewhat above the boiling-water temperature during its lamination. They affirm that their plates of zinc do not readily oxydate by long exposure to the air beyond the first thin coat of oxyd which protects the metal beneath from the further action of the atmosphere. On this account they recommend it for roofing, &c. as a substitute for lead; but if the experiments here related are correct, its use must be confined to those parts that are not exposed to much dripping or to any current of water. With regard to the assertion of the French committee, that Messrs. Hobson and Sylvester's process is taken from Proust's Memoir, we have examined the volume of the Annales de Chimie to which they refer, but do not find in it the smallest intimation of the use of increased temperature in giving this metal its full malleability and ductility. Mr. Proust ascribes the common impurity of zinc to a mixture of arsenic, copper, and lead, and proposes distillation as a means of purifying it.

Experiments on the Decomposition of Ammonia, by Mr. THENARD.---*Ann. Chim. Tom.* 85.

When pure ammoniacal gas is passed through a red-hot porcelain tube, it is decomposed though slowly and with difficulty; but this is facilitated by filling the tube with fragments of porcelain to multiply the surfaces of contact.

But when the tube is filled with iron, copper, silver, gold, and platina (which were the only metals tried in these experiments) the ammoniacal gas is decomposed with much more ease,

though not equally by each metal, for iron succeeds with the greatest facility, and next to this, copper, silver, gold, and platina. Iron also will decompose ammonia at as low a heat as cherry-red, whereas the other metals require a much higher heat.

In every case the gasseous products are merely azote and hydrogen, in the proportions of one to three of the latter, which are those that are considered by the most accurate experiments as the precise composition of ammonia. None of the metals gain any sensible encrease of weight in the operation, but the iron becomes quite brittle, and the copper equally so when heated short of its melting point.

If the above statement be quite accurate, it remains a subject of difficulty to account for this great change in the tenacity of the iron and copper, by a circumstance which does not affect the other metals.

Analysis of the common Mushroom. By M. VAUQUELIN.—*Ann. Chim. Tom.* 85.

WE gave a short account in No. 1 of our Retrospect, of a very elaborate and skilful examination of several species of *Champignon*, by M. Braconnot, who has discovered in this singular class of vegetables a number of new substances, differing in some degree from any of the common vegetable principles, and such as are not assembled in any other vegetable. M. Vauquelin has given a short sketch of a similar chemical analysis, conducted with his usual skill and sagacity, which confirms in a good measure the results of M. Braconnot, though with some exception.

We shall give as brief an abstract of these experiments, as can be intelligible to our chemical readers.

Some common esculent mushrooms, with the skins peeled off, were bruised in a mortar with water and strongly pressed. This was repeated till the water came off quite tasteless. The pressed mass, or *marc*, was reserved for separate treatment. The liquors were all united and filtered. The filtered liquor soon turned blackish in the air. With nitric acid, acetate of lead, and infusion of galls, it coagulated, and also at a boiling heat a matter separated, much resembling albumen, but black. Some of the entire juice was evaporated to a soft extract, and then digested repeatedly with alcohol. The portion left undissolved by the spirit, was then digested with water, but much insoluble matter still remained, which, when dry, was black, hard, brittle, smooth in its fracture, giving much ammonia when distilled, and in short appears to be *albumen*, retaining some colouring matter. The portion dissolved by the spirit, evaporated to dryness, and again treated with fresh and boiling spirit, gave a solution, which, on cooling, depo-

sited white silky and slightly saccharine crystals. This kind of sugar collected and examined, differed from common sugar in being much less sweet, in burning with a more pungent smell, and in some other properties, but still it may be considered as a peculiar *saccharine matter.*

The watery solution of the extract of mushroom, contained many salts, with an animal matter, resembling gelatine, the nature of which is obscure. The portion of the mushroom extract, soluble both in water and spirit, gave a dry brittle mass on evaporation, which is powerfully deliquescent, burns with the smell of scorching roast meat, when dissolved, is totally separated by infusion of galls, and exactly agrees with that modification of animal matter, called by the French chemists *Osmazome.*

The marc of the mushroom, (or that portion of the bruised plant which is left in the press after the action of water is exhausted) is equally singular in its properties. It is largely soluble in boiling alcohol, and this solution deposits, on cooling, a white, flocculent greasy matter, crystallized when slowly cooled, and which has the closest resemblance to *spermaceti* or *adipocire.* After this, another greasy matter remains in the spirit, which partly resembles *wax* and partly *animal fat.*

Lastly, that portion of the marc which yields neither to water nor spirit, appears to consist of a substance not much differing from common *ligneous fibre.*

We take no account of several saline matters in this place.

The results of this analysis present some very singular matters, and well account for the very peculiar qualities of the mushroom tribe. The large quantity of albumen in particular explains why, on cooking these vegetables, they become firm and dense, why they afford a good substantial and very favourite food to many carnivorous animals, whilst the herbivorous animals never touch them; and also shews the source of the strong fœtid smell, resembling that of animal putrefaction, which mushrooms give out when decaying. The peculiar sugar, and the adipocire of the mushroom, afford equally interesting objects for further enquiry, which we are glad to find is announced by the eminent author of the present experiments.

Method of obtaining Manna in Hungary and Croatia. By the Marquis of BRIDIGO.—*Ann. Chim. Tom.* 86.

THE Marquis of Bridigo having quitted Calabria, went to settle in Croatia. The large ash forests in this country suggested to him the idea of extracting manna from them, in the same manner as is done from the same trees in Calabria, the climate of Croatia being not much different from that of the colder and more mountainous

regions of Calabria, which yield the manna in the greatest perfection. A specimen of Croatian manna having been examined by the medical faculty of Vienna and Pest, (among whom was the celebrated Jacquin) and a most favourable report having been given of it, M. Bridigo set about extracting it in the large way from the Croatian forests. The mode of proceeding is very simple. During the month of August horizontal incisions are made through the bark of the trees at two inches distance from each other. A stiff leaf is fixed in each incision to serve as a spout for the juice to flow over, and to drop clean into a receptacle of leaves, at the foot of the tree, without trickling down the bark, and thereby getting foul. In Calabria, the leaves of the cactus are used for this purpose. Some persons have apprehended that the trees would be injured by this multitude of incisions, but M. Bridigo found that after two years they all became cicatrized, and the trees continued in full health and vigour. This agrees too with the uniform observation made in the Calabrian forests, and with the known harmlessness of the process of extracting the saccharine juice from the maple in North America.

It appears that the forests of Hungary, whence M. Bridigo obtained his manna, abound with all the three species of ash, common ash, *fraxinus excelsior*, the proper manna ash, *fraxinus ornus*, and the *fraxinus rotundifolia*, and they all seem to yield the manna with equal ease. Though this establishment of M. Bridigo is but in its infancy, it appears to promise as much success as the moderate consumption of a valuable article, only used in medicine, can insure. It may further be found by experiment, whether the same article can be obtained by inspissating the liquid juice which may be extracted abundantly from the same tree by the assistance of fire.

Account of a Fire Escape, invented by M. DAUJON.—*Bulletin de la Societé d'Encouragement; or Rep. Arts, No.* 135.

A series of ladders, mounted upon a cart, and unfolded by means of a windlass, enables a person to reach those who are in danger. By attaching a bag to the window, which is managed by persons on the ground, a descent may be made in safety.

Observations.—The description of this Fire Escape is extremely obscure; from the little that can be made out, it appears to us, that it has neither novelty or merit.

Account of a Fire Escape used at Geneva.---Bulletin de la Societé d'Encouragement; or Rep. Arts, No. 135.

A tube of coarse cloth sufficiently large to contain a man, is attached to a window, the lower end of the tube is a little raised above the ground and closed, but has a slit in its upper side. Persons entering by the upper orifice, will slide down by their own weight, and may regulate their descent by extending their hands and feet. The sick, &c. should be wrapped up, and lowered in it by a cord. Twenty persons have descended by it in one minute and fifty seconds from a fourth story. It has been successfully employed at Geneva.

Observations.—The Secretary of the Societé d'Encouragement or his English translator, is by no means so clear in the description of these inventions, as their importance deserves. In this article there is great confusion. The machine has simplicity, and is very portable; but the principal difficulty is in expeditiously elevating and fixing the apparatus to a great height.

Mons. A. M. Brun's *Patent (French) for a Thrashing Machine.---Rep. Arts. No.* 135.

A horse-wheel puts in motion an horizontal axis, into which sixteen jointed flails are inserted, the sheaves are laid upon a raised floor, and receive the blows in continual succession.

Observations.---The numerous and ingenious contrivances, which have been given to the public in this country, for a machine of a similar nature, may be proudly contrasted with the paucity of invention in the construction before us. If such rude attempts meet with the encouragement of a patent, we must conclude that agricultural machinery is in its infancy in France.

Account of Experiments in Stereotype.---By M. Genoux, *from the Journal des Arts, &c.---Rep. Arts. No.* 134.

The principal improvement described by M. Genoux, is the invention of a paste, by which he is enabled to take an impression from a page of moveable characters,---This impression has the important property of hardening into a durable mould, unalterable by time, and which he preserves in preference to the stereotype plates. The composition of this paste he does not communicate.

Observations.---In those particulars which are most import-

ant to be known M. Genoux, like many of his predecessors, in this art, preserves a careful silence. The acquisition of a paste possessing the properties described by M. Genoux is a desideratum.

Specimens of the advances which our own countrymen have made in stereotype, with some remarks on the progress and importance of the art, will, we are informed, be given to the public in a short time, by Mr. Horne, of the Surrey Institution in an elaborate work on Bibliography.

REVIEW OF SPECIFICATIONS OF PATENTS.

Mr. John Hughes's *Patent for a Method, or Apparatus, for raising Gravel or Earth from the bottom of Rivers or Pits, and for screening and delivering the same into Barges, or other receptacles. Dated March* 27, 1813.—*Rep. Arts. No.* 134.

A hollow cylinder, of convenient diameter and length, is laid horizontally, part of it being perforated or grated—within this is a spiral plate or screw of a diameter nearly equal to the aperture. Upon the gravel being thrown into one end of the cylinder, a rotary motion forces it by means of the spiral towards the other end. In its course it passes over the grated parts. The sand and smaller stuff are there separated, and fall into one vessel, and the larger carried on to the end of the cylinder, where it may be discharged into another,

In this manner the gravel may be conveyed in an horizontal line; or even upwards, by raising the discharging end—On the contrary, by lowering the discharging end, the perforated cylinder may be used as a screen, without the spiral or screw.

If the drum or cylinder be fixed below the surface of the water, gravel or earth may be raised by it instead of the usual machinery; and at the same time the small stuff be deposited through the grated parts, in the river.

A vibrating or stationary trough, having gratings of the required sizes in its bottom, may also be useful for the purposes of screening.

Gravel, ballast, coals, breeze, &c. may by this machine be advantageously sifted and conveyed into carts, vessels, or other receptacles.

Observations.—This is a modification of the Archimedean screw, a well-known hydraulic machine. Its use has been hi-

therto confined to raising fluids, in situations where the difference of level has not been very great. The Patentee has endeavoured, by detaching the spiral from its surrounding cylinder, and giving one a motion independent of the other, to render it serviceable when other materials are to be removed. The idea is ingenious, and its application as a sifter, or separator, may in some cases be convenient. Its general utility is more than doubtful.

The size of the machine, its weight, and the power necessary to keep it in action, will prohibit its application to all temporary purposes. It will be very inconvenient to remove; and, probably, the only purpose for which it can be eminently useful, is that delineated by the Patentee in his Specification. It is there placed upon a barge, and connected with a steam engine, for the purpose of raising and screening ballast.

The successful application of this machine under water, appears to be very problematical.

The vibrating trough, though mentioned in the Specification, cannot be the subject we apprehend of any patent-right.

Mr. THOMAS ROGERS's *Patent for a Method of constructing Wheels of all sorts of Carriages. Dated Nov.* 28, 1812.—*Rep. Arts. No.* 134.

These wheels are described to be entirely of iron; the naves of cast, the spokes of wrought, and the rims either wholly cast, or wrought and cast united.

The rims are to be moulded for casting in the ordinary manner, and the spokes laid in their respective situations: their outer extremities connected or not, at pleasure, by a ring of malleable iron. The rim is then cast upon the spokes, and the whole permitted to cool. The nave is cast in the same way. When wrought iron is used, the surfaces are to be cleaned by an acid, and covered with a flux to promote union or adhesion.

Observations.—That a compact wheel will be the result of this process cannot be doubted. It may also, by the use of wrought-iron spokes, be constructed much lighter than a cast iron one of equal strength. Still whether the strength necessary for light carriages will not require these wheels to be heavier than convenient must be a matter of experiment. The jolts will be very sharp, as there will be no quality in the naves to deaden the shocks.

The greatest objection probably to the use of these wheels will be the liability of the fellies to break with sudden shocks when loaded. The difficulty, and sometimes utter impossibility of repairing them in such cases is evident.

Much will depend upon the union of the two kinds of iron;

if this be not perfect, the looseness of the spokes in their respective mortises, will be the certain consequence of cooling; and the action of the carriage to which these wheels may be attached, will continually tend to increase it.

Cast iron naves and fellies have already been the subject of a patent, and are noticed page 76, of our sixth volume.

Mr. JOSEPH HAMILTON'S *Patent for certain new Methods of applying well-known Principles in the Construction and Formation of Earthen-Wares. Dated Dec.* 6, 1812.—*Rep. Arts. No.* 135.

Clay, prepared in the usual manner, is placed in a box where it can be conveniently submitted to pressure, and the bottom of which has a perforation exactly corresponding to the section of the vessel which is to be formed. Beneath this perforation is placed a stop, having a cavity equal to the thickness of the bottom of the intended vessel. The clay being forced into this cavity until it exudes from a small hole called the test-hole, forms the bottom of the vessel; the stop is then liberated, and the subsequent protrusion of the clay, through the perforation in the box, forms the vessel of any length required. Spherical, conical, and other vessels, not of a cylindrical or prismatic figure, are formed by the application of moulds to the perforated box, into which moulds the clay is to be driven.

Observations.—This is an application of the process made use of to form the little tubes of paste called macaroni. In the formation of circular earthen vessels it precludes the present mode of turning, and has a great advantage over it in the construction of vessels of a prismatic form. A very considerable saving of time we conceive may be obtained in the expedition with which the articles may be completed by an apparatus of this nature; and great advantages seem very likely to arise from the adaptation of this principle to the manufacture of chimney-pots, sugar-pans, and all the larger and coarser kinds of earthen-ware.

Mr. FRANCIS CREW'S *Patent for Improvements in the Mariner's Compass. Dated January* 30, 1813.—*Rep. Arts. No.* 135.

The card of this compass containing the magnetic needle, is constructed hollow for the purpose of floating in a liquid Alcohol, which from its property of not freezing in very great degrees of cold, is the liquid preferred; and is contained in a metallic bowl

suspended by gimbols in a box, after the usual manner. The liquid is secured within the bowl by a plate of glass. To the under side of this plate is cemented a metallic point which is received by a small inverted cone on the middle of the superior surface of the card. To diminish the pressure of the floating card against the metallic point, a small weight is attached to the inferior side of the card, this acts as ballast, and keeps it in an horizontal position, adjusting the pressure on the point to about 24 grains Troy weight.

The vibratory motion of the bowl is retarded by a tender spring affixed to it externally, and pressing against a concentric metallic dish; or the same effect may be produced by attaching the spring to the box, and suffering it to press against the bowl.

By this arrangement, the oscillation of the several parts is greatly prevented—and the wear of the point of action very much diminished. The weight on this point, in an ordinary mariner's compass, is seldom less than an ounce and a half or 720 grains. In this improved compass 24 grains only are the whole amount of the pressure.

Observations.—The objects proposed by the Patentee are in a very great measure attained. The suspension of the card is ingenious, and its pressure or friction upon the central point may be reduced to nothing, without impeding in the smallest degree its circular motion. Experiment, it appears, has also decided the beneficial effects of this new disposition.

Messrs. Fox *and* Lean's *Patent for certain Improvements on Steam Engines, and their Apparatus. Dated Dec.* 10, 1812. *Rep. Arts, No.* 136.

In this construction the air for the consumption of the fuel is not permitted to enter the lower parts of the fire-place in the usual way, but is injected or forced through one or more openings, by any suitable machinery, attached to the steam engine itself, or connected with any other first mover.

The steam which after each stroke usually passes into the condenser or the open air, and is there lost, is collected into a reservoir, from whence it may be applied to other engines, or to any of the various purposes for which steam is used.

The flues, &c. from the first boiler are carried round the steam reservoir, which is, by this means heated, without additional fuel.

The adaptation of these improvements to engines on other constructions is easy and advantageous.

Observations.—The two principles on which the Patentees profess to have founded their improvements, are

1st. That an artificial blast will produce an equal quantity of heat with one-fourth less fuel than the usual open draught.

2d. That the separation of that part of the boiler, which is immediately over the fire, will permit steam of a higher temperature to be collected, which might be advantageously applied in its passage to a lower temperature.

The economy promised by these patentees is very considerable, and that in a most important assistant in the machinery of this country. If we were quite satisfied that the action of the piston would not be impeded by the discharge of the steam into a reservoir already charged, we should consider this patent as one of high merit.

Mr. PETER NOUAILLE'S *Patent for a method of saving Water in mechanical and hydraulical Purposes. Dated Oct.* 5, 1812.—*Rep. Arts. No.* 137.

In the application of water to overshot wheels, the Patentee proposes that it shall commence its action at a point in the circumference of the wheel, which shall be about 53 degrees from the vertex; by this means a larger wheel may be used in situations where the fall would permit a smaller only if the water were applied at the top.

The pentrough is made to discharge the water through its bottom, and therefore nearly in the direction of the wheel's motion.

Observations.—The very confined view which some men take of the world they live in, and the inventions of its inhabitants, seduces them into the belief that every thing which has the air of originality to them, must be equally new to their fellow mortals: a more extended view would correct this mistake, and very considerable time and expense would be saved, by an examination of the labours of those who have gone before, or who are still existing around us. The most approved principles for the best application of water to large wheels, have been deduced from experiments instituted by some of the best practical philosophers in this country. These trials have been so numerous and so accurately described that no ground is left upon which any man can build an exclusive right; at least it must be for very different objects than those described by this Patentee. However, the opening in the pentrough is judiciously placed.

AGRICULTURE.

Method of attracting Rats and Mice, and taking them alive: by T. A. KNIGHT, *Esq.—Farmer's Mag. No. 55.*

The method of taking Rats and Mice, described in this paper, was made public by Mr. Broad, a farmer, at Thruxton, in Herefordshire; who, in consequence, received a public reward for the discovery.

He states, that the first object to be attended to is the trap, which differs but little from the common box-trap; the most approved size being two feet long, eight inches wide, and nine inches deep, inside measure; the bridge on which the rats tread being made of tin, or very thin iron; and a grate in each door of iron wire, to attract the rats to the light, and thereby prevent them from gnawing other parts of the trap. The traps, when prepared, should be set either close to the holes, or where the rats come regularly for their food.

The materials for attracting rats are oil of carraways, and good pale malt, ground for brewing, and not discoloured in the drying: the proportion of the oil of carraways to the malt being about as 1 to 9000. Much care is to be taken in preparing and setting the traps, and any deviation from the directions will often destroy all chance of success. Small trusses of clean straw, of about an inch in diameter, rubbed with the hands, previously moistened with a drop or two of the oil, to be spread in the traps, and more straw laid all round the traps; and five half-pints of the malt are to be rubbed between the hands moistened in the same manner, and then spread on the straw in the traps in small quantities. The traps are to be left for two or three days with the doors fastened up, and fresh supplies of the malt to be given, as the former quantities are eaten. And after the rats have acquired sufficient confidence to enter the traps without distrust, the catching them may commence; but the traps must be previously baited again, and the straw, if wanted, be renewed, and every thing be made to appear as nearly as possible in the former situation; and in baiting them the hand of the person who has been preparing the malt, which will of course be strongly scented, must alone be introduced into the traps. The morning is named as the best time for commencing catching, as the rats may be most conveniently taken out during the day; and particular care must be taken not to hurt the rats in taking them from the traps; for their cries never fail to excite terror and distrust to all in the vicinity.

Similar measures are to be taken for the destruction of mice, but the same degrees of precaution are not required, as mice

are not so capable of distinguishing things by the smell as rats are.

Observations.—When the annual value of the crops of wheat and oats alone is reckoned at 25 millions sterling, and that one fiftieth part of this is supposed to be every year destroyed by rats and other vermin; the importance of their destruction cannot but be duly appreciated, and every probable means for effecting it be readily resorted to.

Experiments to supply the partial failure of Clovers. By W. *Farmer's Magazine, No.* 55.

The writer of this article having learned, in the course of his reading, that Mr. Salter, of Winberg, in Norfolk, had practised a method of covering the bare patches of his meadow-lands with a valuable herbage by sowing them with winter tares and white clover, was in 1810 induced to apply the same principle to some places destitute of clover plants among a wheat stubble: he therefore sowed all the naked places with winter tares on the 9th of October, and found an ample compensation for his labour and expense by a fair average crop in the following summer, which was very advantageously applied to the soiling of horses and milch cows.

The result of the first experiment proving so favourable, the same thing was repeated in 1811, and the crop was, in 1812, made into hay, and given to horses with much advantage; the quantity of seed sown was at the rate of about two bushels to the statute acre, and it was harrowed in with a common harrow.

Observations.—In searching books, for the purpose of agricultural information, many hints are frequently struck out which may lead to improvements in practice. Every farmer, on reading of a new practice, should consider whether he can devise an easier or less expensive method of effecting a similar improvement, and whether the principle may not be applied to other cases with equal success. The author of this communication appears to have reaped the advantage of such reflections; and his success should be an incitement to similar experiments.

On the Utility of Smearing Sheep, with an Account of Experiments with different Materials. By a Storemaster. Farmer's Magazine, No. 55.

Notwithstanding the title of this communication induces the reader to expect some opinion on the utility of smearing Sheep, the author declines saying how far it is either useful to the animal

or hurtful to the wool, and contents himself with relating the experiments he made, and the different substances he employed. The old practice had been to mix about four pounds of butter melted with a Scotch pint of tar, which was deemed sufficient for six or eight sheep; but when tar became very dear, he had recourse to tobacco-liquor, mixed with urine and black soap, and this answered well the first year, but in the second year much of the wool peeled off, and in the third more; and the stock was so reduced in carcase, as to be scarcely of any value. Fish-oil, from Newfoundland, was then had recourse to, and seemed to answer very well; but after two or three years, the sheep suffered more from inclemency of weather, and were much reduced in their milk. Butter-milk and tar, in equal quantities, were also tried; but under this application the wool became matted together; and whenever whale-oil was substituted for butter, the stock was universally infested with the scab. The writer also states that he had observed the snow, in heavy falls, quit the backs of sheep smeared with tar and butter, much sooner than when any other material was used, and that he had always found the wool of such sheep much softer and warmer than that of others; and he is not friendly to the use of sheep-houses in winter, as he finds animals kept in a warm place through the night can endure no cold in the day; and that those not housed at all bring the strongest and most healthy lambs.

Observations.—These experiments, beyond any opinion of the writer, proved the preference due to tar and butter, before any other mixture for the smearing of sheep.

On the Application of Schistus, or Coal-Sill, as Manure. By T. F.—*Farmer's Magazine, No.* 55.

Schistus, or coal-sill, is described to be a substance composed of argillaceous earth and sulphurate of iron, with a small portion of alum: it falls in length of time, by exposure to the atmosphere: lime immediately decomposes it, and forms it into gypsum. Its use as a manure was first ascertained by sowing wheat and clover on the bank of a coal-pit, near Workington, in Cumberland, which had been previously ploughed and limed; the crop, both of corn and seeds, proved abundant; and subsequent mixtures of this substance with lime, in the proportion of six parts to one, were found to be excellent manure for light lands.

Observations.—It may be useful in many parts of the country to know that this substance, heretofore disregarded, which is always found with coal, may be useful as manure, when mixed with lime in the proportion mentioned in the communication.

On Planting Trees. By A. S.—*Farmer's Magazine, No.* 55.

On the Distance at which Trees should be Planted, in Reply to A. S. By M. E.—*Farmer's Magazine, No.* 56.

On the Soils adapted to different Sorts of Trees, and at the Distance at which young Trees should be Planted. By E. S.

In the first of these papers the writer enquires into the most proper distance at which trees should be planted to form a beautiful and flourishing plantation, and suggests that twelve feet is not too great an interval for these purposes.

The second author, on the authority of great experience resulting from planting in Derbyshire, asserts that this distance is much too great, and thinks that eight feet is the greatest interval which ought to be allowed, if the plantation is not intended to be afterward thinned; but he prefers four or five feet as a better original distance, and recommends thinning out the trees as they continue to grow; since the injury occasioned by planting too thin would soon be visible in the shoots of the young plants sent forth during the summer, dying for want of shelter in the winter season; an evil, however, which he admits may be remedied by subsequently planting in the intervals.

The writer of the remaining paper agrees in opinion with the immediately preceding author, that planting too thin at first is seldom productive of a flourishing plantation; he thinks, however, much more information on this subject may be collected from *Nicol's Planter's Kalendar*, than he is able to communicate; and that soils ought to be considered with reference to exposure, climate, &c. and cannot of themselves form any obstacle to success with an experienced planter.

Observations.—These anonymous communications on the subject of Planting are noticed not with a view of their affording any new matter; but, that our readers may be convinced we have not passed over unnoticed any of the *few* original papers in these two Numbers of the Farmers' Magazine.

On the planting of Potatoes; by a Gardener. Farmers' Magazine, No. 56.

The mode recommended is to put the potatoes into the ground uncut, at the latter end of April, at two feet distance each way; and it is contended that by this method the quantity of haulm is much diminished, and great crops of very large potatoes raised without any manure.

Observations.—The mode recommended in this communication is that practised generally by the best agriculturists in the southern counties of England.

Experiments in Crossing the Lothian Cows with an Argyleshire Bull; and in rearing Calves with Oil-Cake, as a Substitute for Milk. By H. F.—*Farmers' Magazine, No.* 56.

The writer, who dates his communication from East Lothian, having determined to try a cross between the West-Highland cattle, and those of his own district, procured a bull from Argyleshire of the best description; the calves proved good milkers, and one of them at three years old fattened very well. And in rearing the calves before they were fit to live on grass, a quantity of oil-cake was broken into small pieces and thrown into a tub, upon which boiling water was poured; the whole was then carefully stirred together, and when the liquor became sufficiently cool, the cake was broken up with the hand, and the mixture given to the calves, who did equally well upon it as with milk.

Observations.—That many breeds of cattle may be improved by crossing, has been too extensively known to be deemed any new experiment; and the rearing of calves on dissolved oil-cake, or on boiled linseed, has been long practised in many parts of England.

On Hay-Tea; by the Rev. Timothy Priestley.—*Agricul. Mag. No.* 7.

This communication, in the shape of a letter to the Earl of Rothes, states that the writer purchased a cow, which gave 18 quarts of milk in 24 hours, when fed on good grass, but only five quarts when kept in the house and fed on hay; but that this was increased to 14 quarts when he had induced her to drink tea made of hay; the quantity of hay used was 16lb. of hay to 50 gallons of boiling water.

Observations.—It might reasonably be expected that this increased consumption of food, would produce an increased quantity of milk (for we do not conceive the cow lived on tea only) but how far it is desirable to carry this practice must be determined by repeated experiments on a more extended scale than a single animal.

On the Smut in Wheat; by Inquirer.—*Agricul. Mag. No.* 7.

On the Smut in Wheat; by an Observer.—*Ibid. No.* 8.

The first of these writers, without offering any opinion as to the cause of this disease, dissents from the generally received

opinion that it proceeds from the seed not being sufficiently prepared or steeped before it is deposited in the ground; for he has tried many kinds of pickle, and found smut occasionally after them all; he has steeped wheat in sea-water for 24 hours, and fresh limed it; he has employed urine, and fresh water and common salt, and limed it; without finding any of these modes to be depended on in all seasons; he also has found smut when the fallows and clover lays have worked well, and when they have worked badly, and has observed that upon the best land, in the best possible cultivation, smut will be found in some seasons. He doubts therefore whether this disease proceeds wholly from the seed, and whether it does not arise from the seed conjointly with the land in which it is deposited, and whether dressings are not therefore inefficacious; and whether it may not arise from some injury received by the plant between the root and the ear.

The observer, in reply, thinks it equally reasonable to suppose the smut to arise from some insect injuring the ear itself, since it is the result of every day's observation, that the moisture and nourishment of plants are robbed by various insects; and he agrees with the former writer in the uselessness of steeps and dressings.

Observations.—Till the cause of smut be better understood than it is at present, we cannot agree with the recommendation of discontinuing steeps and dressings in the preparations of seed wheat; for though they may not be an infallible remedy for the evil complained of, yet they may lessen its effects, and therefore ought not to be entirely disregarded.

On the Orchis Root, Mulberry Trees, and Silk Worms; by C. M. *Agricul. Mag. No.* 7.

On the Orchis Root, the Silk Worm, &c. by CHARLES HALL. *Ibid, No.* 8.

On Food for Silk Worms; and various Articles of Culture; in Reply to Mr. HALL *and Mr.* HOLDITCH; *by* C. M.—*Ibid. No.* 9.

These papers chiefly relate to the expediency of cultivating the orchis root, as a culinary vegetable, and to the best mode of raising and managing silk worms; the management of these delicate insects seems to be well understood by Mr. Hall; but his directions do not well admit of an abridgment. The value of the orchis root is very doubtfully spoken of, and the miscellaneous parts of the papers do not afford any thing new or interesting.

On the most economical Method of consuming Crops of Turnips and Cole; by Mr. HOLDITCH.—*Agricul. Mag. No.* 8.

After some high-flown compliments to Mr. Noel, to whom the paper was originally addressed, Mr. Holditch proceeds to state that the method recommended was first practised in 1806, by Mr. Buckworth, of Glinton. It consists in cutting up the cole with a knife, and then cutting the plants (and turnips in the same manner) into small pieces, and giving them to the cattle in troughs, instead of hurdling the crop off to be eaten in the field; and he suggests that an old chaff-box may be so altered as to make a convenient machine for cutting into pieces both turnips and cole.

Observations.—The utility of giving winter food to cattle in such a manner as to prevent waste is universally admitted; and the method here recommended by Mr. Holditch (though the practice obtained in many places for some years before Mr. Buckworth followed it) deserves the attention of every farmer, whose crops of winter food are too deficient to be wastefully consumed.

On plucking off the Blossoms of Potatoes; by C. M.—*Agri. Mag. No.* 8.

This beneficial practice is asserted to have been followed for many years, though it has been only recently recommended through the medium of the press. The writer, from a conviction of its increasing the produce, advises that the practice should not be confined to gardens, but be extended to the field culture of potatoes.

Observations.—If the increased produce should be sufficient only to pay the expense of employing children in this way, it ought to be resorted to, as it would be teaching them habits of useful industry, while they would seem to be doing little more than plucking flowers for their amusement.

On the Festuca Duriuscula—hard Fescue Grass; by Mr. W. SALISBURY.—*Agricul. Mag. No.* 8.

This grass, which grows in some parts of Sussex, is said to be more grateful to sheep than any other; but when once it has taken possession of a field can scarcely ever be again eradicated. It is very slender, the stalks being nearly as fine as hairs, and some measure 30 inches in length; but they more generally trail

on the ground than grow upright. It is stated that Mr. Curtis has described this grass as apt to become thin, and almost to disappear after a while; but from this opinion Mr. Salisbury dissents, as he finds it stand dry weather equal to any other grass, and forming a delightful turf in such seasons, by becoming matted together in the ground.

Observations.—The favourable opinion of so experienced an horticulturist and botanist as Mr. Salisbury, ought to recommend the culture of this grass to those sheep-farmers to whom it is at present unknown.

On the Culture of Turnips upon Clay Lands; by a Practical Farmer.—Agri. Mag. No. 9.

The writer notices a novel opinion which prevails in Scotland, that the only unfitness of clay-lands for turnips is the difficulty of eating, or carting them off; for that they are of superior quality to those produced on any other soil whatever, and that the Scotch butchers are so convinced of this, that they will always give a greater price for cattle fed upon clay-land turnips. And he states that his residence in the Rodings, in Essex, has made it necessary for him to sow occasional crops of turnips, potatoes, and barley, on clay soils, but that he has never, but in one instance, done it with success; he conceives therefore that the opinion prevalent in Scotland on this subject will prove to be not well founded upon further experience.

Observations.—We have noticed this paper the more readily, because we conceive it to be always useful to warn the inexperienced against disappointment, where there is but little probability of success.

On the thick and thin sowing of Wheat; by Mr. BATCHELOR. *Agri. Mag. No. 9.*

Mr. Coke having been in the habit of publicly recommending the use of large quantities of seed wheat, even as far as four bushels and a half per acre, Mr. Batchelor was induced to make trial of this plan in Bedfordshire, where two bushels and a half was the quantity usually sown. He drilled 20 rows of wheat across the middle of a field after the rate of four bushels and three pecks to the acre, and the same number of rows at something less than two bushels and a half; the drills were all at nine inch intervals, and were horse-hoed in the spring. The produce of an equal portion of both was equal in measure—$30\frac{1}{4}$ pints;—but the weight of the thin sown parcel was $28\frac{1}{2}$ lbs. and the thick sowed was

only 27¾ lbs.; making a difference in weight of more than two pounds in the bushel.

Observations.—This experiment seems to shew that Mr. Coke's opinion may be well founded as far as it regards the soil in the neighbourhood of Holkham, yet it cannot be universally adopted without loss to the farmer.

On the Merino and Wool question; by L.—*Agri. Mag. No.* 9.

In this paper some account is given of the management of the Merino flock at Kew, which was the property of his Majesty; and it is contended that the Merino breed of sheep may be brought to fatten equally well with any other kind. The habits acquired in Spain, where wool was the only object in keeping them, are admitted to be unfavourable to feeding; but as they are merely *habits*, the writer conceives they may be easily changed by different management.

Observations.—We agree with this writer in his opinion, that the Merino sheep may be made to acquire a disposition to fatten by a length of similar treatment with that of Mr. Bakewell towards the new Leicesters; but we doubt whether the fine quality of the wool can be preserved at the same time.

On early sowing of Turnips; and on Rutabaga; by C. M., *Agric. Mag. No.* 10.

It is recommended to sow turnips even as early as April, or in the first week in May at the latest, as they would be then much less injured by the drought of the summer, and time would be afforded to the roots to attain their full size and perfection by Michaelmas, when the weather might be expected to be more favourable for carting them home, than at a later period of the year.

Rutabaga, (Swedish turnip), is said to be used in Kent for feeding pigs with considerable success.

Observations.—The advantages of sowing turnips early has never been denied, but the practice is so extremely limited, because farmers at that season are compelled to sow spring corn. And as for Swedish turnips for pigs, we have no idea that the practice will be durable.

Report on the Expenses and Produce of two Acres of Hemp, drawn up in the year 1808; with practical Observations on the Management of the Crop; by Mr. HOLDITCH.—*Agri. Mag. No. 10 and 11.*

The excuse offered for publishing at the end of 1813, an account of the produce, &c. of a crop of hemp in 1808, is that the subject of the supply of hemp from Canada, had been discussed in the New Series of the Agricultural Magazine; the writer offering his own experiment as a proof that hemp might be raised at home, and that profitably to the farmer. The expenses incurred in the cultivation of these two acres is stated to be £.46 18s. 6d. the produce was 32 bushels of seed, at 8s. 6d. per bushel=£.13 12s. 0d.; 74 stone of long hemp, at 12s. (one guinea abated) =£.43 7s. 0d.; and 15 stone of short hemp at 5s. =£.3.15s. 0.; giving a produce of £.60 14s. 0d.; and a profit of *Fourteen Pounds* on the two acres.

Respecting the SOIL AND ITS PREPARATION, it is observed that grass land once ploughed is extremely well calculated for the growth of hemp, if it be well drained; for no crop is more easily destroyed by water; and provided the land be rich enough, no crop requires less nicety of management; the worst soils for hemp being low fen land, high gravelly land, and cold retentive clay; and the best rich lands which have been long in pasture: the best preparation, an abundance of manure, or the burning the old turf; the latter end of March is deemed the preferable time for ploughing, that the land may be cleaned of root weeds and harrowed fine in April, and manured sufficiently in the beginning of May.

The best time for the SOWING is the first fortnight in May, if the weather be mild and favourable, for frosts would injure the young plants; the quantity of seed two bushels and a half to the acre, if the crop be intended for seed hemp; but if, for manufacture, four bushels are required: the sowing should be broadcast, and the seed slightly harrowed in; and sufficient drains should be made to let off the top water.

WEEDING is seldom required, for hemp grows so much faster than all small seeds, as to smother them before they run to seed.

PULLING commences about the middle of September, if the crop be sown early; and in this operation the male stalks intended for manufacture are to be separated from the female intended for seed.

STOUKING AND COVERING are terms used to signify the tying the stalks into bundles, and drying them preparatory to

THRESHING AND WINNOWING, which two operations are carried on together; and when the seed is winnowed out, the

stalks are consigned to the various processes which fit them for manufacture. These processes are enumerated in the original paper, but being altogether unconnected with the agricultural department of hemp, the more anxious enquirer is referred for them to the magazine itself.

Observations.—The importance of hemp, as one of the most valuable naval stores is universally admitted; but it can scarcely be expected to become an object of general cultivation in England, so long as it can be obtained in sufficient quantities from foreign countries; since it requires for its profitable cultivation the very best land in the kingdom. Amateur cultivators of hemp on a small scale may derive some valuable hints from this paper of Mr. Holditch.

On the Culture of Cabbages on cold rough Land; by S. S.—*Agri. Mag. No.* 11.

The land, which is the subject of these remarks, was in a rough state of hill and dale, as neglected pasture land: it was levelled and fenced, and ploughed up in November, and sown in the spring with Tartarian oats, which produced a heavy crop of straw; and this, being mingled with the natural grass, was excellent fodder in the succeeding winter. The writer conceives that he would have a much more profitable crop, if he had planted the whole with cabbages, instead of sowing the oats.

Observations.—We cannot agree with the ideas of this writer entirely, though a plant of cabbages would have enabled him to have subdued the weeds by the hoe; but in fresh land, cabbages almost always run away to seed instead of producing a valuable crop.

Description of the new Turn-wrest, or right and left-handed Plough, invented and manufactured by JAMES BRABY, *Vine-street, Lambeth; with Observations on Turn-wrest Ploughs. Agri. Mag. No.* 11.

It is difficult to convey an adequate idea of this plough without a reference to the plate which accompanies the description in the magazine. The BODY of the plough (if the expression be allowed) is not fixed to the beam, but to a separate piece of wood, and is furnished with a share at each end, instead of having only one share; the piece of wood above-mentioned is made fast to the beam by an iron pin passing through both, on which the body

turns, so that either end may go foremost; and the consequence is that the furrows are all laid in one direction. The Observations merely point the utility of this kind of plough on the sides of hills, where it is impracticable to plough the land into ridges or stiches in the usual way.

Observations.—This Machine certainly appears preferable to the old Turn-wrest Plough used in Kent, Sussex, and Berks; and we may safely recommend it as an improved implement of husbandry.

On burning Clay as a Manure; by CULTIVATOR MIDDLESEXIENSIS.—*Agri. Mag. No.* 12.

The experiment noticed in this paper was made during the summer of 1784, in a Midland county; the land levelled in the autumn, and planted with beans in December; the clay on the top of the ridges having been previously dried and burned, and the ashes spread over the land. The expense was under £25. for ten acres, the quantity subjected to the experiment; the land produced such crops in succession, as had never before been seen upon it, and the staple remained ever after in the best style of modern tillage.

Observations.—If the advantages resulting from this experiment were really as great as they are described to be, the practice is of primary importance; but perhaps circumstances, which occurred thirty years ago, may not be recollected with the nicest accuracy.

Persons desirous of obtaining Patents for Inventions (either for England, Ireland, or Scotland), may, by application to the Editor of the Retrospect, addressed to the care of the Publisher, have them procured, with little trouble to themselves, and receive assistance in preparing and adjusting their Specifications; on the accuracy and perspicuity of which, in a great measure, depends the security of the Patent.

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CHEMISTRY, ARTS, AND MANUFACTURES.

Observations on the quantity of Carbonic Acid Gas emitted from the lungs during respiration at different times and under different circumstances. By WM. PROUT, M.D.—*Thomson's Annals of Philosophy, Vol. II.*

IT has long been known, in a general way, that the quantity of oxygen consumed in respiration, and the carbonic acid produced, varied very much in the same individual under different states of the system. These states however have never as yet been pointed out with any precision, and this has induced the author to undertake a long series of experimental observations on respiration, the results of which are given in the present interesting paper.—Having first contrived a simple apparatus by which the respired air could be analyzed with considerable accuracy, as far as the single point of finding the proportion of carbonic acid gas, the author put himself on an uniform regimen, and began his arduous task of examining the respired air every hour during the day, and occasionally during the night, which was continued with little intermission for upwards of three weeks. The results obtained from this mass of evidence, amounting to many hundreds of experiments, were generally consistent, and seem to establish the two following laws:

1st. The quantity of oxyen gas consumed, and of carbonic acid formed during respiration, is not uniformly the same during the twenty-four hours, but is always greater at one and the same part of the day than at any other; its maximum occuring between ten in the forenoon and two in the afternoon, and its minimum from half-past eight in the evening to half past three in the morning.

2d. Whenever the quantity of oxygen gas consumed, and consequently of carbonic acid formed, has been by any means raised above the natural standard of the period, it is subsequently as much depressed below that standard, and *vice versa.*

In explanation of the first law, Dr. P. observes, that in his case, the minimum of carbonic acid gas formed during the night is 3.30 cubic inches in 100 of the respired air, and this begins to encrease at first slowly, afterwards more rapidly till about noon, when it is usually as high as 4.10 per cent. its maximum, after which it gradually falls again as the evening advances. Hence the highest quantity exceeds the lowest by about a fifth of the whole. The mean quantity given off in the 24 hours is 3.45 per cent.

Among the variations of this law, the author notices the varying quantity of carbonic acid gas given off by the same individual on different days, and the variation in its quantity as given off by different individuals.

With regard to the former case it is, in fact, constantly occurring, for no two days are exactly alike. A remarkably large maximum of carbonic acid is noticed on a particular day (the 22d of August) for which no satisfactory reason could be given, but that it was not owing to any peculiarity in the state of body of the author himself, was proved by the same circumstance happening to a friend who was present at the time. Some other similar variations are noticed, which are also given in a tabular form.

The quantity of carbonic acid produced by different individuals varied extremely, certainly much more than might at first have been expected. It was found however by Messrs. Allen and Pepys, in their valuable experiments on respiration, that the last products of a single expiration contained nearly three times the carbonic acid of the first portion, which will account for much of the apparent discordance on this head. The average of 3.45 per cent. as the mean of the 24 hours which the author found, in his own case, is lower than the lowest quantity given by any other experiment.

Some important general observations are added. The circumstances which immediately *encrease* the quantity of carbonic acid appear to be comparatively but few, while those which *de-*

creases it are very numerous. Moderate exercise seems always at first to encrease the quantity, but if prolonged so as to induce fatigue the quantity is diminished. Violent exercise on the other hand seems to lessen its quantity from the very first. It would be expected that the chemical nature of the food should influence most materially the production of carbonic acid; but the author's experiments have not been directed to this point with any great minuteness. Long abstinence does indeed lower the production of carbonic acid, but not in any very material degree. But the effect of fermented liquors was very well defined. Alcohol, and all liquors containing it, diminish the carbonic acid uniformly and in a remarkable degree. Even porter after dinner has this effect, whilst the reverse is the case when only water is drank. When spirituous liquors are taken on an empty stomach the effects are the most remarkable, the depression of the quantity of carbonic acid is almost instantaneous; after a short time the powers of the constitution appear to rally, the carbonic encreases even beyond the usual average, and then slowly subsides. Strong tea has nearly the same effect as alcohol in this respect.

The depressing passions of every kind, and whatever produces yawning, sighing, or any other deep inspiration diminish the carbonic acid. Even great anxiety in any particular object has the same effect, so that the author states, that it has more than once happened to him to be foiled in his wish of exhibiting experimentally the diurnal encrease of carbonic acid at the middle day, by the very solicitude to demonstrate the fact.

After giving, in a tabular form, the particulars of these experiments, the author adds some general observations: He remarks, that though there can be no doubt that the state of the circulation must materially affect the production of carbonic acid in respiration, his experiments shew that this bears little, if any, relation to the frequency of the pulse. It is true, that the mere frequency of the pulse will not alone determine the force of circulation, unless its strength and fullness be also taken into the account, so that this point requires further examination. Mr. Brodie, in his valuable memoir on poisons, having shewn that respiration is dependant on the state of the brain, and that alcohol and other poisons introduced into the stomach appear to act chiefly on the nervous influence originating in the brain; this will serve to explain the very great and sudden depression in the most obvious effect of respiration, namely, the production of carbonic acid, immediately following the reception of alcohol or any fermented liquors into the stomach. A plate is added to this memoir shewing the simple apparatus with which these experiments were performed.

In addition to this paper given in Dr. Thomson's Annals for November 1814, Dr. Prout states, that having been particularly struck with the sudden encrease in the quantity of carbonic acid emitted from the lungs in the morning about the commencement of twilight, he performed a series of experiments about the winter solstice, which was continued at intervals nearly till the summer solstice, so as to include all the variations in the sun's rising. These experiments are confessedly very imperfect; but yet they seem to shew some coincidence between the occurrence of twilight and the increase of carbonic acid in so many examples, that they can hardly be attributed to accidental causes.

Observations.—The author of this very interesting paper, seems well aware of the comparative imperfection of those experiments, and of the danger of hastily drawing any general deduction from them. Nevertheless, they are undoubtedly curious and important, and well deserve to be pursued. With regard to the method of making the experiment, it is of less importance in the present defective information on that head, to have a perfectly accurate mode of analyzing the respired air, than to possess a simple, easy, and short method of operating, in which the probable errors may be pretty uniform, and thus will not materially affect the general question, whether there is really a regular diurnal variation in the proportion of carbonic acid from a maximum to a minimum at stated hours.

On referring to the accurate experiments of Messrs. Allen and Pepys on respiration, made by chemists eminently expert in the practical part of the science, we find the remark, that in ordinary respirations much of the inspired air appears to return unaltered, viz. that contained in the fauces, the trachea, and probably a portion of that in the larger branches of the bronchia. Hence there is found a great difference in the quality of the first and last portions of a single inspiration, the first containing, as appeared by experiment, no more than about 3.5 per cent. carbonic acid, whilst the general average appears to be about 8 per cent. and the last portions that can be expelled from the lungs by a forcible expiration contain about 9.5 per cent. The average of 8 per cent. of carbonic acid as here stated, is so much higher than that of Dr. Prout as to be entirely unaccountable, except from the great imperfection in the mode of experiment, which this gentleman has adopted, perhaps in no circumstance more striking than the substitution of a bladder to a gasometer to contain the expired air. Dr. P. who is fully aware of this great difference between his average and that of the other chemists above mentioned, is inclined to attribute it chiefly to th actual variation in the quality of the

first and the last portions of the expired air; but as the air which he analyzed was always part of the product of six entire expirations made in as uniform a manner as possible into the receiving bladder, we do not see how this explanation of the difference can be allowed.

One more remark we may add: Dr. P. states, that "whenever the quantity of carbonic acid formed is by any cause raised above the natural standard of the period, it is subsequently as much depressed below that standard, and *vice versa*." If this were the case the mean number of each period of 24 hours ought to be the same at all times, any accidental encrease being afterwards compensated by a proportional diminution. But on inspecting the results of twelve days successive experiments, we find no small variation in the mean of each day and night, the highest mean being 4.19 per cent. and the lowest only 3.82.

However these are circumstances of less importance, while further experiments seem still wanting to establish what the present render extremely probable, namely, the fact of a diurnal and stated change in the proportion of carbonic acid, the maximum being about noon day and the minimum about midnight. We hope the author of these experiments will find opportunity to continue them with that degree of accuracy which their importance demands.

On the composition of the Oxyd of Zinc. By THOMAS THOMSON, M.D. F.R.S.—*Thomson's Annals, Vol. IV.*

THE mean of the experiments of Berzelius, Davy, and Dr. Thomson himself, in a former occasion, gives the composition of the oxyd of zinc to be 100 of metal to 23.175 oxygen. But as these were made upon the common zinc of the shops which contain lead and copper, Dr. T. has repeated this enquiry, using a different mode of conducting the experiment. Some sulphuric acid of 1.13993 sp-gr. at 60°. was first examined; to ascertain its proportion of real acid 100.4 grs. of the acid were diluted with water, neutralized with a base and decomposed by muriate of barytes. Three successive experiments gave 223.78 and 226.7 grains of ignited sulphate of barytes, which, (reckoning this earthy salt as containing 100 acid to 194 barytes) will give the respective quantities of 74.564, 75.813, and 74.910 acid, the mean of which is 75.096, and this agrees almost exactly with Mr. Dalton's estimation of the strength of sulphuric acid. Into 100.4 grains of the above acid diluted with water, a plate of zinc was immersed

for twenty-four hours till the liquid no longer reddened litmus. The quantity of zinc dissolved was 62.7 grains. The experiment was twice repeated with little difference in the result. Hence, calculating the quantity of real acid in the above liquid sulphuric acid; the author concludes from the mean of three experiments, that 100 grains of real sulphuric acid dissolve and are saturated by 82.859 grains of zinc.

From the experiments of Berzelius and others, Dr. T. considers it as established that 100 parts of real sulphuric acid are neutralized by such a quantity of any base as contains 20.02 of oxygen. Therefore the 82.59 of zinc must have previously combined with 20,02 oxygen before it was dissolved by the sulphuric acid; hence 100 parts of the acid dissolve and are neutralized by 102.879 oxyd of zinc, and this oxyd is composed of 82.859 metal and 20.02 oxygen, or of 100 metal to 24.16 oxygen. Berzelius gives 100 metal to 24.4 oxygen which is almost exactly the same. The common sulphate of zinc of the shops will generally redden litmus, and hence contains a slight excess of acid.

On an easy Method of procuring a very intense Heat. By Alex. Marcet, *M.D. F.R.S.—Thomson's Annals, Vol. II.*

The process here mentioned consists simply in urging the flame of a spirit-lamp by a current of oxygen gas. The gas is expelled from any convenient gasometer through a capillary jet-pipe which opens close upon the flame of the spirit-lamp. The effects of this flame are truly surprising and exceed those of any other known mode of heating, except perhaps the charge of the very largest voltaic apparatus. Platina wire of moderate thickness is instantly melted, and globules of this metal, weighing four or five grains, are obtained in quick succession. It was by globules thus procured that Dr. Wollaston succeeded in drawing platina wire of extreme minuteness, as described in our last number. During the melting of the globules a scintillation of the metal is observed, as if in combustion, but which may be only owing to the dispersion of minute particles by the intensity of the heat. Iron wire is burnt in this way with peculiar brilliancy, and small needles of quartz are readily melted and vitrified by the same means.

Instructions on the art of making Glue and Size. By M. HERMBSTAEDT—*Ann. Chim. Tom.* 86.

THE memoir here given is extracted from the *Bulletin des Dècouvertes dans les Sciences et les Arts*, for Sept. 1812; and the author, a very eminent German chemist, states, some improvements that he has introduced in the art of glue-making, particularly in the use of sulphureous acid to bleach the material, which he asserts to be peculiar to himself. In most other respects the process (which indeed is extremely simple) does not much differ from that pursued in this country, where the best glue in Europe is manufactured.

The author of this memoir describes the process under eight separate heads, of which the following is a short extract.

1. *Of the Materials.*—These are various refuse animal matters, such as, the feet of sheep and lambs; those parts of the hide about the head, tail, and feet of tanned hides which are cut away and not used for leather; the clippings of parchment; the scrapings of skins after they have undergone the first *handling* previous to their entering the tan-pit; the intestines of animals; bones, both raw and boiled; the raspings and waste bits from the bone or ivory turners and button-mould makers; the raspings of horn; and all sorts of hair and bristles, but with regard to these last their use seems rather doubtful. With regard to intestines, the glue is finer and stronger from the old and lean animals than from the young and fat.

2. *The cleansing of the materials.*—A thorough rinsing in clear cold water till it comes off quite clean is in general sufficient for the feet, bones, horn, and intestines, but the clippings of hides, when in preparation for leather, require a much longer and more complete soaking to get out the lime employed by the tanners and other leather-makers in the first part of their work, and which if left in, would materially injure the quality of the glue. These clippings and refuse bits of hides therefore are first soaked in water to soften them, and then are stamped or fulled either with the feet or with beaters till the lime is entirely extracted, and then either hung up to dry for use when required, or else immediately boiled down for glue.

3. *The boiling down of the materials.*—The boiler used by glue-makers is either of iron or copper, of greater depth than breadth, and set in brick work in such a way that the flame can only reach the lower part of the vessel. It has a wooden cover which fits closely. The boiler is charged with the sheeps feet chopped into bits an inch or two thick, or with the clippings of

hides recently softened by soaking, and water, or the weak liquor of the former boiling is added, and the whole stirred constantly till it boils, and the soluble part is dissolved; but the sheeps feet are again boiled with a second water, which liquor is reserved for the succeeding extraction as already mentioned.

4. *Clarification of the liquid jelly.*—When the contents have boiled long enough, the fire is drawn, and the liquid is passed through a sieve into a very deep wooden vat, kept in a warm room, where, after some hours, the impurities and insoluble portions subside, and the fat rises to the top, leaving the pure jelly in the middle. This is drawn off through a plug, fixed at a quarter of the height of the vat, the stream being stopped just before the grease begins to come, and the jelly is now quite clear and pure.

5. *Concentration of the liquid jelly.*—If the materials are very rich in jelly, the clarified liquor will be thick enough, when cold, to be immediately cut up for glue. But if it remains a thin clear jelly after cooling, it is slowly boiled down in a pan, till it is properly concentrated. But as this second boiling down of the jelly, makes the glue less transparent and of a worse quality; it should always be avoided if possible, which is done, by proportioning the water to the solid materials in the first extraction, that it may remain quite stiff after the first cooling.

6. *Conversion of the jelly into hard glue.*—The clear jelly whilst still warm and liquid, is poured into a large square wooden box, twelve or fourteen inches wide, the sides of which will readily take to pieces.

When the jelly is quite stiffened into a hard elastic mass, the sides of the box are knocked away, and the glue itself is cut up into cakes. This is done by a wire stretched from two handles, like that which the soap-makers use, and the mass of glue is divided by it lengthways into slices of an inch thickness, which are then cut up by a knife into cakes, six or eight inches wide.

7. *Drying the glue.*—The slices of soft glue are hung on packthreads, stretched in rows across a wooden frame, which are set in a granary or other dry airy room, till they are hard enough to break short when twisted, which is the point of dryness to which the glue is brought. This mode of drying can only be adopted in the middle of summer, for in cold wet weather, the glue would putrify before it can dry, and then it turns of a deep brown colour. On the other hand, the soft glue-cakes must not be exposed to the direct rays of the sun, or they would liquify and drop through the threads. The temperature of the air greatly affects the colour of the glue; when it dries rapidly, it is clear and

transparent, but if it remains long on the threads, it becomes brown, and is then of a very inferior quality, and is peculiarly unfit for the paper-makers.

Bleaching the glue.—As a very clear glue or size, without any shade of yellow, is required by the paper-makers, it is of consequence to find some method of destroying its colour, which can only be done when it is still fluid. M. Hermbstaedt, the author of this memoir, gives the following as his process: Into a long necked glass retort, set on a sand-bath, is put a pound of wood saw-dust, and as much concentrated sulphuric acid, and the neck of the retort is then closed with lute, leaving in the orifice a cork, pierced, to receive the shorter end of a glass syphon, the longer of which, dips into a narrow cylindrical wooden vessel, holding the liquified glue to be bleached. As soon as the sand-bath, on which the retort is set, is heated, vapours of sulphureous acid are disengaged, which, passing through the glue, completely deprives it of colour. With 4lbs. of sulphuric acid and 1lb. of saw-dust, sufficient sulphureous vapour is given out to bleach as much liquid jelly, as will furnish 100lbs. of dry glue.

Glue thus bleached, contracts a sour taste which must be removed. This the author advises to be done, by adding to the above proportion of glue, 1 lb. of pulverized oyster shell, stirring it in well, and then letting it settle till all acidity is removed, and till it no longer changes the colour of litmus. The glue must be kept warm and fluid whilst this is taking place, after which it is divided and hardened in the usual way.

On the Pistons of Pumps. By M. De Bonard, *Mining Engineer.—Journal des Mines, and Rep. Arts. No.* 132.

The first part of this paper is occupied with the following description of a method, used in Saxony for some years past, of making pistons for sucking pumps, without using external leathers. The part of the piston which forms the bucket, is composed of small moveable pieces of wood, cut obliquely, and so disposed, as to cover each other nearly half their breadth; a leather which covers the upper surface of each of these pieces serves to sustain them, and yet allows them sufficient play. To the under part of the same, pieces of leather are attached, which affords them all the elasticity that is necessary. These leathers are received into slits, that are cut round the piston, and directed obliquely to its edges; they are fixed to the pieces of wood by nails, and to the edges of the piston by screws. By this disposition each piece of the wood is moveable on a sort of horizontal hinge, and when the piston is raised, the weight of the water

with which it is charged, causes these pieces to press against each other, and against the sides of the barrel of the pump so as not to let any of the water escape, and to produce completely the effect of a piston furnished with leather. The interior edges of the joints of the moveable pieces, are covered two by two with leather, upon which the weight of the water acts as upon the pieces themselves. All these leathers last a long time as the friction only acts on the moveable pieces of wood. These pistons were tried in several mines in Saxony in 1808, and proved very satisfactory.

After the above description, an account of metallic pistons follows which are composed of four metallic segments of brass, about two inches thick and as many high, pressed from the center of the piston against the side of the pump, by two springs each, and are so cut at their extremities as to lap over half their thickness, so as to admit of no air, or fluid to pass. These pistons are used in iron cylinders, and are stated by the author to have been chiefly applied in the manufacture of blowing engines.

Observations.—We should be much gratified if some of these wooden pistons were brought over to this country, as models.

The metallic pistons are no new invention, nor have the French the least claim to the contrivance, though this is insinuated in the original papers; for it is well known that they were introduced here many years since by the Rev. Edmund Cartwright, who obtained a patent for them, and other improvements in steam engines, in Nov. 1797. From some difficulty in the workmanship they were little used for a long time; but of late Mr. Woolf has discovered a method of making them fit so well by grinding them in the cylinder, that they succeed perfectly; and promise to come into general use, from their great reduction of friction in the working of steam engines. A gentleman who used one of them in an engine of no very large dimensions, near Westminster Bridge, has informed us, that the piston of his engine, when stuffed in the usual manner, required a force equal to that of more than four horses to draw it out of the cylinder, but that since the piston has been fitted with metallic segments on Mr. Woolf's plan, two men can perform with ease the same operation. For an account of other inventions of Mr. Woolf see our early volumes.

Account of improvements in Montgolfier's hydraulic ram. Annales des Arts, and Rep. Arts, No. 137.

These improvements consist, 1st. in widening the body ram, in a curved form, which falcilitates the entrance of the water as

much as possible, and thus augments the effects of the machine. 2d. In substituting hollow balls for flap valves. 3d. By the addition of a small sucking valve, which admits at each pulsation a quantity of air into the head of the ram, from whence it is expelled at the following pulsation into the compressing reservoir, which would be filled with water, if the air lost by absorption were not removed by this method. 4th. By so disposing the valve of ascension, that between its outer sides, and the inside of the head of the ram, there shall be a volume of air, which cannot be driven into the reservoir, but which is compressed at each pulsation by the power of the water. In consequence of these improvements the shutting of the valves makes less noise, all the operations take place with more gentleness, the machine is less shaken, less liable to want repairs, and its construction is rendered more simple.

Observations.—We agree with the publisher of this article, that all the above described alterations in this hydraulic engine are improvements of consequence; but we cannot acquiesce in letting it pass as a French invention. The claims of England to it have been long since published and proved; but as the French continue to call it Montgolfier's ram, it cannot be amiss to repeat, that an account of a similar invention is to be found in the Philosophical Transactions, for 1775, which was put in practice at Aulton, in Cheshire, at the seat of Philip Egerton, Esq. and that precisely the same contrivance is to be found in the specification of Mr. Boulton's patent for hydraulic engines, dated Dec. 1797, inserted in the 9th vol. of the 1st Series of the Repertory of Arts, &c. An account of other similar engines may be seen in our 2d. volume, page 160.

REVIEW OF SPECIFICATIONS OF PATENTS.

PUBLISHED IN THE REPERTORY OF ARTS, MANUFACTURES, &c.

Patent of Mr. SAMUEL SMITH, *for an improved Escapement for Watches, calculated to make them beat dead seconds, and parts of seconds, by means of clock pallets attached to a lever, operating on a vertical wheel. Dated Dec.* 1812. *Rep. Arts. No.* 130.

MR. SMITH thus describes his improved escapement: "The 'escapement wheel, which is made of brass, steel, or other

"metal, stoned or not, with ruby or other stone in an hori-
"zontal position, on whose arbor is affixed a wheel to drive a
"pinion in the balance, to which balance is affixed the pendu-
"lum spring, to render the motion at once steady and secured."

Observations.—We fear that, whatever merit the invention may have to which this specification relates, it is described with too little accuracy to render the patent of much use to the patentee; on this point however we leave our readers to judge for themselves, having copied literally for this purpose the only description given by the patentee. We have also given the title of the patent at large for the same design, as it tends to throw some light on the description.

From both together we conceive that this escapement somewhat resembles that of a common clock, but that on the arbor to which the pallets are attached, a wheel is fixed, which gives motion to a pinion on the point of the balance. If this idea of it be correct, we can venture to say it is no new invention, as we recollect seeing at Liverpool and Birmingham many years since, watches with a pinion on the balance moved by a wheel, or the segment of one, attached to the arbor of the pallets; when we were informed, that this method was the invention of a watch maker at Liverpool, where they were in common sale; watches on this plan were understood to go well, but we never heard that they were put in competition with timekeepers, or chronometers, as done by the patentee among many other encomiums on their merits.

Patent of Dr. JOHN MORGAN, *for a new power applicable to the propelling of boats, and vessels of every description through the water, and also to the pumping them. Dated Dec.* 1812.—*Rep. Arts. No.* 187.

DR. MORGAN'S invention, consists of a floating buoy, shaped like a boat, placed behind the stern of the vessel to be impelled; from this buoy, one, two, or more beams, extend to the stern of the vessel, to which they are united by a joint, which admits of the motion of the buoy up and down freely behind the vessel.

The machinery for moving the vessel, or that for pumping (which may be of any of the known kinds) is connected to the aforesaid beams by wheels, levers, or other mechanical means; so that the motion of the beams and buoy up and down shall give

the required motion to the machinery; which up and down motion will be given to the buoy by the ascending and descending of the waves, and will act with a power equal to its buoyancy in the first case, and equal to its weight in the latter.

Observations.—If any one has witnessed the effect of a storm at sea, or indeed has read an accurate account of one, he must be sensible that such an apparatus as that described must endanger the vessel extremely by tearing away its stern; that it could not be used at all with safety, but when the waves were very moderate; and that if it were framed so as to be taken into the vessel in bad weather, it would form a very troublesome encumbrance, at the very time when seamen are willing to part with even what they know to be of much utility, to free themselves from impediments in working the ship.

Besides this objection, it is only in calm weather, when there would be no waves to give motion to the buoy of the patentee, that machinery to impel the vessel could be absolutely required; as whenever there is wind and sea room, sailors know how to advance the vessel by tacking, somewhat quicker than most mechanical means could impel it, unless the wind were directly contrary; in this case the patentee himself, we apprehend, cannot be so sanguine as to suppose, that his contrivance for propelling vessels would have any beneficial effect.

Patent of Colonel Sir Wm. Congreve, *for modes of constructing locks and sluices of Canals, Basins, and other works, and generally for the transporting of floating bodies from one level to another. Dated March* 1813.—*Rep. Arts, No.* 137.

In the specification of this patent several methods of constructing locks are described, of which the first seems preferable. A correct idea of the first invention may be attained by supposing two common canal locks, of the same dimensions, placed close together, so as to communicate with the same upper and lower levels; inside these locks, at a small distance from the walls, other walls are to be erected from six inches to a foot higher than the difference of the level; and between the spaces enclosed in each lock by these latter walls, a channel of communication is to be formed from beneath by pipes, or arched passages, which completes the stationary part of the construction.

The moveable part of the apparatus consists of two inverted caissons, formed of wood or iron, or a combination of both;

the area of each being such as to admit of their being moved up and down in the locks without touching their sides, or the internal walls built within them; in the space between these walls and the sides of the locks, the sides of the caissons are to be made to work up and down, in such manner as to leave the least possible interval; the depth of the side of the two caissons is to be equal to that of the minor walls, and they are to be connected by a chain passing downwards from one to the other, through the channel of communication, beneath rollers placed at the extremities of this channel, so that when one caisson is raised, the other must be drawn downwards; the chain is to be of such length, as to allow for the quantity of the motion required in the caissons for the difference of the levels, with which the lock communicates. So far we have copied the description in the specification, but must add, to make the arrangement of the caisson more intelligible, that the minor walls, as represented in the plate, are so much lower than the lower level of the canal, that water sufficient to float a boat may lie above them, when the lock is emptied to the lower level.

To put this apparatus in a state of action, one of the caissons is to be raised in the lock so near the upper level, that a boat may have just room enough to float above it, while the other is lowered a corresponding distance below the lowest level; water is then to be procured from the upper level into both the locks at once, until a sufficient quantity is accumulated on the upper caisson, to be on a level with the water in the upper level in the canal; at which time the water above the lower caisson, will in like manner be on a level with that of the lower level of the canal. The lock will then be charged and fit for action. The caissons will support themselves by the air confined beneath them, and will shift alternately up and down, on the application either of a depressing power to the highest, or a lifting power to the lowest; provided the water has, in the above operation, flowed in equal quantities upon both caissons; if not the adjustment will be completed on the first shift, by opening the gate of the upper level into the lock, in which the caisson is then raised; after which, allowing for defects of workmanship, two barges may be transferred at once from one level to the other by this apparatus, whatever their difference of weight may be, without the loss of any water whatsoever.

To work the caissons so as to lose no water, some external force must be used; and the patentee thinks that for this purpose that of two men will be sufficient, working a wheel and axle, or a rack and pinion. But they may also be worked without the force of men, where the loss of a little water is no object, by letting the water in on the upper caisson from the upper level, a little

before it is raised to its greatest required height; by which means an accumulation of weight will take place in an instant on the upper caisson, which will immediately cause it to descend, and the lower one to rise, on the handle of the rack and pinion being freed.

When any variation takes place in either level of the canal, either above or below the standard height; the adjustment may be made for this circumstance, by opening and shutting the gates of the different locks separately; instead of performing these operations in both locks at the same time, as required when the levels are at the standard height.

Variations may be made in the caissons, without diminishing their effect, as they may be formed of a combination of separate vessels, in place of one large one; by which if any accident happen to one of the parts, it may be removed without disturbing the whole; the caissons also may be constructed so as to hold a certain weight of water, by having their middle parts formed into a descending vessel of the depth required, by which weight the buoyant pressure of the contained air may be so balanced, that the connecting chain between the two caissons may be entirely dispensed with, if desired.

The patentee next describes certain varieties, which may be made in this principle of the lock, which however he does not recommend to be used. The first of these is, that the lock may be made a single one, and the co-agent may be a detached part, acting only as a counterpoise, in which case the form may be varied in any way.

The co-agent may also be formed of a number of cylinders, with solid loaded pistons; or it may consist of an enclosed vessel, by means of which the rising and falling of the caisson may be effected by the alternative expansion and condensation, or accession and escape of air, gas, or steam.

The space under the caissons may also be filled, instead of air, with any fluid lighter than water; or they may be made to operate by filling the space between the minor walls and the sides of the lock, with a fluid heavier than water, as with quicksilver.

The patentee next describes another species of double balance locks, which he calls the *balloon double balance lock*. This consists of two inverted caissons, called the balloons, arranged as those first described, but each having a complete interior lock, fixed upon them, of the same area as themselves, and furnished with a complete set of gates, so adjusted as to fit close to those of the outer lock; the outer locks are then filled one half, or more according to circumstances, with water; and two caissons being connected by a chain and double fusee wheel, so that when one is up the other must be down, it is evident that a system of

equipoise will be thus established, by which two barges may be passed at the same time.

This system may be applied either for a great or a small lift; and may either have the interior lock fixed directly down upon the buoyant caisson; in which case part of the caisson emerges from the water of the outer lock occasionally) or the interior lock may be fixed to the caisson at any height above it, in which case the caisson need never emerge from the water, which dispenses with a part of the compensating weights, though it requires a greater depth of the lock. The caissons may also be made with or without a bottom, hollow and air-tight, or of any light solid substance; and a lock on this principle may be either double or single, retaining the property of being balanced, so as to work with facility, either by the wheel and axle, rack and pinion, or by a moderate sacrifice of water.

The patentee next describes his third system of double balance locks, which he calls the *bouyant plunger lock*. Two locks on the common construction, double the breadth of the barges intended to be passed, being placed near each other, without any communication; half of the space in each lock is to be occupied by a buoyant plunger. Each of these locks is to be half filled with water, and the caissons are to be so connected by a chain and double fusee wheel, that when one rises the other will be depressed. The mode of managing these plungers is similar to that for the balloon lock, last described; and the water being raised on the side where that one plunger is immersed, and, lowered on that side where the other plunger is raised, the boats can be passed from either level into them, and be transported from these to the other level, as required.

This mode of changing the levels may be also applied in a single lock by a counterpoise. Only a single set of gates is required in this lock, but in all its varieties the plunger must be equal in its cubical contents to the whole water contained in the lock.

Lastly the patentee states, that the plans described are applicable to differences of level in rivers, docks, and elsewhere; as well as in canals; that they may be used for passing burthens over any difference of level in railways, by having side ponds or reservoirs placed near them; and that they may be also applied for raising and lowering goods to and from warehouses, (where the up and down work is equal in certain times,) upon large moveable and floating platforms, balanced by reservoirs at top and bottom. For which better purpose the patentee prefers the single balloon principle, before mentioned; which may be applied to it, by having a deep well containing a caisson of sufficient buoyaney, with a water vessel and floating platform supported

upon it by an upright beam, of any length, proportioned to the depth of the well. This method is not proposed for lifting single packages, but for raising or lowering large quantities of goods at one operation.

Observations.—The first method proposed by Colonel Sir William Congreve for transferring boats to and from different levels without loss of water, appears to be far superior to any yet published in the chief requisites of cheapness, facility of repairs, and little liability to derangement. Of the many methods proposed for this purpose, that of pumping the water back by a steam engine from the lowest level to the higher, so as to supply a lock on the usual construction, is the only one in common use; and an instance of it may be seen near London on the Croydon canal: but we are satisfied a short experience would prove that Sir William's method would be found much cheaper, even though the first cost might be more (which however would not be the case in all instances) as the expense of coals for the steam engine must be considerable, and would be entirely saved in the method recommended by Col. Congreve. We hope it will not be long before we shall have occasion to give some account of this invention being put in practise, as we understand that the Regent's Canal Company have directed that excellent workman, Mr. Maudsley to construct one on that canal. We are however apprehensive that what the patentee calls the ram or walls, would be too liable to leakage and derangement, if formed of masonry, as the name implies; and therefore beg leave to recommend them to be made in the same manner as the sides of the caisson, properly secured below the masonry of the lock. We agree with the patentee entirely in the opinion, that the other methods proposed for the same purpose in the specification, are very inferior to the first, and therefore shall not give them a more particular consideration, with the exception of the method of raising and lowering the caisson, by forcing air beneath it, and again abstracting it; we think this latter contrivance in some cases might be advantageous, and be less expensive than the other methods, as only a single lock without any side reservoir would, where it was used, be required. Other patents of this ingenious Baronet have been noticed in our preceding volumes.

Patent of Mr. JOSEPH BRAMAH, *for improvements in the method of constructing and laying down Pipes for the conveyance of Water, and for applying the same to a variety of useful purposes. Dated Oct.* 1812.—*Rep. Arts, No.* 137.

THE specification of this patent comprises many subjects, which shall be stated in the order given by the patentee.

The first consists of a method of obviating the great inconveniencies which the public suffer from having the streets intersected by the pipes of no less than nine water companies. This method consists in substituting a single main pipe in each street, in place of the number now used, which is to be of smaller dimensions than the others, but is to be supplied with a constant stream of water, urged by a much greater pressure than any hitherto used for this purpose, instead of the limited and interrupted supply at present afforded.

This plan Mr. Bramah calculates, could be effected at less than a sixth of the present cost for the supply of water to the metropolis, and would, in the course of twenty years save many millions, and be attended with the prevention of accumulated fires, by the powerful supply of water afforded at all times, and would have many other material advantages.

The second object of the specification is the application of the great pressure of the water in the pipes, conveyed as above stated, to mechanical purposes; for which the best plan mentioned is to have two sets of pipes laid in each street, one to convey the water to various engines either for pressure, or alternating motion (afterwards investible into any species of motion required) and the other set to receive the water after working those engines, but still retaining a degree of pressure, though less than that in the first; which water is then to form a supply for domestic purposes. In this part of the specification Mr. Bramah states, that he is daily in the habit of applying water in hydrostatic machinery, under a pressure equal to that of a vertical column of water of 20,000 feet height; which at least proves the possibility of the speculation. Besides the working machinery for grinding, sawing, forging, pressing, stamping, and other purposes, in any required place, Mr. Bramah proposes to use this method for cranage of goods; by applying the force thus conveyed, to expand an engine formed of a number of concentric tubes placed one within another, on the principle used in an opera glass. The pressure of the water from the main pipe being first applied to compress a large quantity into a vessel of suitable dimensions, this compressed air is afterwards to be admitted into the assemblage of tubes, by opening a connected cock;

which will cause the internal tubes to slide upwards successively, till the whole is expanded to the full extent of the multiplied length of all the tubes.

In addition to the above application of this engine, Mr. Bramah mentions several others, and states that it may be used for hoisting up lights for light-houses, signals, and telegraphs, to a great height with much expedition, that on this principle he can construct an apparatus, which will prevent ships from sinking, even if the whole of their bottoms be lost; and one that can raise or destroy wrecks: he also asserts that this principle may be applied to military purposes in a great variety of ways, and that "bridges, walls, towers, gates, trees, or any other obstacles, can by its use be removed or destroyed, with the utmost ease, and expedition, with little trouble in preparation, noise, or cost." Also that by means of it ships may be launched, lifted on building slips, or hoisted into docks, the most stubborn planks, or timbers may be bent into any curve required, and various other operations used in ship building be performed.

To render engines of this kind, and others of a similar nature, more perfect, by preventing the bad effects of rust on the iron materials used in them, Mr. Bramah proposes here to line his iron cylinders, and cover his pistons, with sheet copper, or brass, by a process similar to the method used by opticians, in making their brass tubes for sliding telescopes, by drawing them through a machine as wire is drawn.

The third object of the specification relates to the construction of harbours and canals, so that they may be easily cleansed of their mud; the moving boats on canals by means of an artificial current; the passing boats from one level to another without locks; and to the formation of flood gates, so that the pressure of the water on them shall be balanced.

Harbours and canals, docks, &c. are to be performed, so as to be easily cleansed, by being made to consist of two parallel basons or canals, having a communication at their heads, and each joining the river, or sea, near which they are constructed, by a separate water way; so that the water may be caused to run in at one extremity and out at the other alternately as required: for which purpose they are to be furnished with flood gates at their junctions with each other, and with the sea, or river. By this means one of the basons or canals may be emptied at low water, while the other remains full, after which the body of the water from the full bason, being made to rush through the empty one, must carry off the mud contained in it.

To cause artificial currents in canals, in order to give progressive motion to boats, Mr. Bramah directs that the canals be be formed double, by a wall of separation between them for

their whole length, but so as to leave a communication at each extremity, and at which places of communication water wheels are to be placed (like the undershot wheels of mills) which being put in motion by any force preferred, will cause the water in the canals to have a current in the direction in which they are turned, in the same manner as the water in a paper-makers cistern, is made to circulate, and any boats floating on the canals will be moved forward of course with the current at the same time.

Mr. Bramah's method of causing boats to pass from one level of a canal to another without locks, is effected as follows:— A wall of partition is to be formed between the two levels; then a strong frame or railway is to be constructed, at a proper height above the upper level to allow a boat slung from it to pass over the wall; this frame or railway is to be of the same breadth as the canal, and being supported by pillars, is to extend lengthways beyond the wall each way sufficiently for the purpose intended; a truck is then to be constructed to run on wheels in the elevated railway, in the same manner of a railway waggon, on which truck one or more, of the hydromechanical engines for raising weights before mentioned, or of common cylinders and pistons, are to be placed; a cradle for the reception of the boat is then to be sunk to the bottom of the canal, from which cradle chains are to pass upwards to the elevating apparatus on the truck; so that the said apparatus is worked, the chains and cradle may be drawn upwards; the boat is to be made to pass into the cradle, and the injecting pumps of the apparatus being set to work, the cradle and boat will be drawn high enough to pass over the wall; the truck with the boat appended to it is then to be moved forward on its wheels, till it reaches its station over the other level, at the other side of the wall; and then, by discharging the water from the hydromechanical apparatus, the boat is to be lowered into the water beneath, and floated off the cradle; which will then be ready to receive another boat, to pass back into the level from whence the first was taken.

The various mechanical operations which are directed to be performed on the canals, Mr. Bramah states can be effected by a single steam engine, or water mill, however distant from the place of action, by the use of the hydraulic apparatus, which forms the second object recited in the specification; and that from the main pipe of this apparatus, carried along the line of the canal for the uses mentioned, collateral pipes may be branched off for any of the general mechanical or other purposes mentioned, to any distance required.

The flood gates, which are to have the pressure of the water on them balanced, are to be thus constructed: a pair of lock gates being supposed to be placed in the usual method, so as to

join water tight where they meet, another gate of similar dimensions is to proceed from the stem of each, at right angles to them; and to the semicircular curve, which will be formed by the revolution of these secondary gates or wings, the side walls of the water course are to be built so as to correspond, and their curvature is to be made to conform so exactly to the sweep of the wings, that no water shall pass between them as the wings turn round; by this means the pressure of the water on the wings will balance that on the gates, so that they may be either opened or shut by a very small power. The flood gates so formed, will besides have the advantage of being made stronger than the gates in common use, as the wings may be traced to the gates so as mutually to support and strengthen each other.

Observations.---A great part of the voluminous specification of this patent, is taken up with the praises of the various objects it comprises, and with the raptures of the patentee, on the wondrous nature, and boundless extent of their applications.

Enthusiasm is extremely useful, if not absolutely necessary, to a juvenile inventor, to enable him to fight his way through the various obstacles, he will have to encounter; but to a veteran, who has passed these fiery trials, and instead of receiving buffets from the world, has it now in his power to confer them, we own we should have expected more temperance, even if the objects of the patent had been of the vast importance, which they seem to be to the patentee.

The first plan mentioned in the specification is liable to many serious objections. If it were possible to force water through a pipe of the small diameter alluded to by the patentee, in sufficient quantities for the purposes stated, it must be effected alone by such a prodigious pressure, as would occasion the bursting of the pipes in innumerable instances and greatly increase the evil attendant on their consequent leakage; where we now see a little pool from such an accident, a flood would then be occasioned, the pavement would be torn up into chasms, and the lives of the passengers endangered. And how could this great plan be effected, but by annihilating the nine water companies which now exist in the metropolis, incorporating them into a new one with the patentee at its head, a project that presents too many practical difficulties for any reasonable individual to calculate as possible to be carried into execution. The outline of the plan is however exceedingly good, for certainly there would be a saving of great expense and much inconvenience in the obstructions at present created in the metropolis prevented, by using a single main pipe, in place of the many which now pass through the streets; but then the plan is only applicable to a new city, laid out as Petersburg was by a

monarch whose will is the law; for to make the nine water companies coalesce into one, or to undo all their charters, and form a new one, would, we conceive be a task nearly impossible; and if effected, must for a long time stop all intercourse in London, from the total demolition of the streets which would ensue from taking up at once the nine sets of pipes at present used.

The second plan, stated by the patentee, though very ingenious, is attended with inconveniencies, which would very much obstruct, if not prevent, its ever being adopted. We will suppose that numerous engines could be worked by water, conveyed by pipes to a great distance in the manner proposed by Mr. Bramah, though we think the difficulty of forcing water enough through a single pipe for this purpose, would be so great, as to be almost insurmountable. Yet who would like to be at the mercy of the proprietor of the water-works, for the working of an engine, on which his trade depended; the proprietor might be of a capricious, or a litigious temper, fonder of opportunities to oppress and annoy, than to promote the interests of those he dealt with; the main engine too that forced the water through the pipes might burst, or be damaged in many other ways, and then the whole set of secondary engines must stand still; the pipes also might burst, to which, from the great pressure of water to be used in them, they would be peculiarly liable, or they might be obstructed by frost, which would also cause the engines to stand still. The water moreover which had passed through the various hydraulic engines, with their cylinders and pistons well covered with rancid fish oil, kitchen stuff, and other unctuous materials, to facilitate their motion, of a nauseous savour, could not, as the patentee proposes, be fit for domestic purposes, as the dirt and bad taste which it must contract, in passing through so much filth, would render it totally unfit either for washing or drinking. And lastly, the proprietor of the works might chuse to exact a greater price for the supply of power than it was worth; when the agreements first made with him expired, or other circumstances threw those who wanted such a supply from him in his power.

We have also to notice that the invention of this mode of conveying power is by no means so new, as the patentee may suppose, since it was prepared by the celebrated Papin many years since; who mentions his having worked an engine, at a great distance from the original power, by air forced through a long tube, which moved a piston up and down at the other extremity.

The engine, which Mr. Bramah proposes for the cranage of goods, for forming light houses and signals for the use of naval dock yards and for military purposes, formed of a series of concentric sliding tubes is undoubtedly a very powerful machine, and a

most ingenious contrivance. We have no doubt however, that, for many of the purposes for which he proposes it, the expense of forming it of a sufficient size would be much too great for practical utility; it must be evident to any one who understands mechanical subjects, that it would require very nice workmanship to make the tubes fit water tight or air tight within one another, if stuffing were not applied between them; and if it were, it is no less evident that so much room would be occupied by the stuffing and the apparatus for screwing it down into its place, that the number of concentric tubes must be very limited, which could be combined in a convenient place, so as to render the engine portable, which is necessary for some of the principal purposes mentioned. The improvement on cylinders and pistons, to prevent their rusting, by lining them with copper or brass, which is mentioned in the same section of the specification with the engine last mentioned, seems a very useful invention; and would certainly have a good effect, if the copper or brass lining can be made to adhere sufficiently to the iron, to withstand the force it would have to sustain tending to detach it.

We next come to the method of forming harbours, docks, and canals, so as to be easily cleared; this method meets our unqualified approbation, and we cannot hesitate to acknowledge its efficacy, since a method so extremely similar has been practised with success at Dunkirk and Ramgate. At Ramsgate, to the best of our recollection, two inner basins were originally constructed by Mr. Smeaton, so as to communicate with each other and with the outer basin, for the purpose of mutually cleansing one another. But at all events the method of cleansing harbours of mud, has been so ably put in practise at Ramsgate by Smeaton, that Mr. Bramah can add but little to it, and certainly can have no claim to originality of invention in the idea. The plan of the patentee which follows this, cannot however have the same objection made to it, as we believe he was the first who ever published a method of navigating boats on canals by artificial currents; but to this the obviously enormous encrease of expense in forming two canals, where one would do in the common mode of management, (to say nothing of the cost of the machinery, and loss of the large portion of ground which must be occupied by this mode,) would be an insuperable objection to its being ever put in practise. We are further of opinion that to establish an efficient current in the parallel canals, many more water wheels would be required, than Mr. Bramah supposes, perhaps one at every two miles; but this is but a trifling inconvenience compared with those mentioned.

Mr. Bramah's method of transferring boats from one level of a canal to another is also objectionable on the ground of expense;

would expose the boats to great risk of damage and destruction; would, from its complicated nature, be very liable to derangement; and is so very inferior to the method proposed by Colonel Sir William Congreve for the same purpose noticed in our present number as to bear no competition with it.

The last article in the specification is the contrivance of the flood gate on which the pressure of the water is balanced. We think that the part of this flood gate, which would have to pass along the circular cavities at the sides, would be very difficult to be kept water tight, on account of the expansion and contraction of the timber work constantly exposed to the weather. For canal locks there would be considerable danger in using this flood gate; since from a slight inattention in the person that turns the gate, such a body of water might be made to pass off at once, as might destroy the masonry of the lock, along with any boat that might be in or near it. We have also to add that we conceive this is not a new invention, for if our recollection do not fail, there is a design similar to it in either Belydor's hydraulic architecture, or among the inventions presented to the French academy; all the difference between that design and Mr. Bramah's plan is, that in it the wing or balancing part, is in the same plane with the gate, instead of being at right angles to it as Mr. Bramah directs.

In concluding this article we must again object decisively against Mr. Bramah's repeatedly calling that very ancient invention, known by the name of the hydrostatic parodox, *his* hydro mechanical principle, and by other expressions claiming it as his contrivance. We are willing to allow Mr. Bramah great merit, in the very beneficial practical purposes to which he has applied this ancient engine, but we must consider his persevering to claim the invention of it as a puerile and useless vanity, when few books of natural philosophy published for these last two centuries are to be found without a description of it under the name mentioned. For our former remarks on this subject see our first Volume, page 401.

HORTICULTURE.

On destroying Slugs in Gardens; by Mr. John Wilmot.—*Horticultural Transactions, Vol. 2, part 1.*

It is avowed in this paper that though the extermination of these ruinous vermin had engaged the attention of the writer, yet that he had rarely obtained success from the improper mode in which the means had been applied; he was however induced to make a trial

of lime-water, at the suggestion of Mr. Whateley, the surgeon, and found it greatly to exceed his expectations. The plan he recommends is to take a small portion of fresh Derking lime, and pour on it some hot water; and when it is thoroughly dissolved, to add water enough to make it pass through a fine rose of a water pot. Previous to the preparation of the lime water some pea-haulm, or leaves of cabbages should be laid in rows about six feet asunder; and if the weather permit, the slugs will be collected under these, both for the purposes of shelter and food; if the haulm be taken up and gently shaken, the whole of the slugs will be left on the ground, and may be easily destroyed by the application of the lime water.

Observation.—This method is as easy, as it is effectual, and a garden may soon be freed from slugs by its adoption.

On two new Apples cultivated in Cornwall; by Sir CHRISTOPHER HAWKINS, *Bart.—Horticultural Transactions, Vol. 2, part* 1.

THE one of these is called the *Aromatic Apple*, and is said to be an inhabitant of Cornwall for centuries, though little known out of that county: the tree is a good bearer, and the fruit is among the best and the latest of store apples: it succeeds well on new stocks.

The other is a new sort of apple said to have been discovered about ten or fifteen years since in a cottage garden near Truro; this apple goes by the name of the *July Flower Apple*, probably from the pleasant smell given out when cut: it has a conical shape, yellowish green colour, with red towards the sun: the fragrance of the smell when cut and the excellence of the flavour of the apple render it one of the best of modern apples.

Observations.—Both these apples appear to be valuable fruit, and to merit more extensive cultivation, than the local circle to which they have hitherto been confined; the favourable notice of the Horticultural Society is among the best means of effecting this general culture.

On the transplantation of Blossom-Buds; by T. A. KNIGHT, *Esq.—Horticultural Transactions, Vol. 2, part* I.

THE experiment of transposing buds from the branches of one plant to the scions growing from the root of another, was first

practised on roots in 1840, in the month of August; and the success with which this was attended led to a number of similar experiments upon the pear and the peach tree. An old unproductive pear-tree, on a north-west wall, was pruned so close as to occasion the protrusion of many strong succulent shoots, and into these were inserted blossom-buds of the St. Germain and long green plum; some of these vegetated and afforded leaves the same year, but others not till the following year; but those buds succeeded best, which were inserted into the bases of the shooting branches of blossoms of the preceding year. Similar experiments were made upon seedling peach trees under glass with equal success; and the buds of the peach tree were afterwards found to set perfectly well in the open air.

Observations.—These experiments evince the vast extent to which nature may be influenced by the scientific gardener, but the delicacy of the operation will be an obstacle to its general application.

A plan of a Fruit-Room, with some account of it; by Mr. JOHN MAHER.—*Horticultural Trans. Vol. 2, part 1.*

THIS fruit room consists of a nest of drawers occupying one side of it from the floor to the ceiling; the drawers are numbered, so that the fruit contained in each may be registered in a book, and its progressive delivery for the table or the kitchen accurately noted. The lower drawers have close bottoms, and are called sweating drawers, the fruit being put into them as soon as gathered. In ten days or a fortnight, as the apples and pears come forward, they are sorted, and the other drawers are prepared to receive them by covering the bottom of each with very clean wheat straw, thoroughly dried and ventilated; the bottom of these drawers is made of trellis work. The room is directed to have sliders both in the door and window to admit a circulation of air in fine weather: but in damp and rains the rooms should be closely shut.

Observation.—This method of keeping fruit possesses all the advantages of complete arrangement, and affords a constant and accurate view of the consumption, and of the stock remaining, by inspecting the register.

Some account of the Eton Pear; by T. A. Knight, Esq. *Horticultural Transactions, Vol. 2, part* 1.

This new variety of pear is described as ripening generally about the middle of September, but must be gathered a week or ten days before it is quite ripe, or it becomes in some degree mealy, and requires to be kept a fortnight before it becomes fit for the table. The fruit is without seed, or internal cavity, and becomes very large if the tree be trained to a wall, but then loses all the fine flavour it possesses on a standard. The original pear is stated to grow at *Eton*, in Huntingdonshire, from which circumstance it derives its name, and to be about the middle size. The tree is supposed to remain in health about three centuries.

Observation.—The recommendation under which this pear is introduced to public notice, will probably give it that general cultivation, which it seems so peculiarly to merit as an autumnal. It will be found an excellent companion to the *Bergamont* pear.

On raising Lemons and Oranges from Cuttings; by A. Hawkins, *Esq.*—*Horticultural Trans. Vol. 2, part* 1.

The writer states that Mr. Luscombe, of Combe, Royal, near Knightsbridge, had discovered a method of raising orange and lemon trees from cuttings, by which he had raised eleven plants out of thirteen. The art is to place the cuttings in the mould deep enough to touch the bottom of the pot; they are then to be plunged in a bark or hot bed, and kept. This method has been scarcely known to fail of success in Mr. Luscombe's practice.

Observation.—Various experiments have been made by different Horticulturists to propagate lemon and orange trees in this manner, but heretofore without success. Mr. Hawkin's merits the thanks of all lovers of the green house for his communication.

On the culture of the Mulbery tree; by T. A. Knight, *Esq. Horticultural Transactions, Vol. 2, part* 1.

This beautiful fruit has been first ripened by artificial heat by the learned President of the Horticultural Society. He states it to be a much finer fruit when ripened under glass, the only means

by which it can be ripened at all in the colder parts of England. This plant in pots will bear fruit in three years old; and layers of the most luxuriant wood which the bearing branches produce afford the best plants, though the wood of the mulberry tree of almost any age will emit roots under proper management. The culture of this fruit under glass has been confined by Mr. Knight to plants growing in pots, and he does not know any species of fruit tree which under such circumstances produces more abundantly, and with less care than the mulberry; as its blossoms set equally well in different degrees of heat, and the fruit ripens in the same temperature as will ripen the early kinds of grapes; and the tree is subject to no injury, except the attack of the red spider.

Observation.—The mulberry has received much less attention in England than its merits deserve; and we hope Mr. Knight's example of cultivating it under glass will be followed by other patrons of English gardening.

Account of a Walnut Tree, which bore fruit at an early period from seed; by ANTHONY CARLISLE, *Esq.*
Horticultural Transactions, Vol. 2, part 1.

THIS walnut tree was raised from a nut of a middle size, thin shelled, and of a compact oval form, which was of a particularly good kind for the table. Six of these walnuts were planted about two inches and a half deep in the month of March 1802. The situation was on the slope of a hill in the County of Surrey, where the surface mould was eighteen or twenty inches deep, and of a very deep colour, and immediately beneath was a fine silicious sand, and the ground had been immoderately manured with stable dung; and the absence of all lickens and moss from the garden fences indicated that the local atmosphere might be considered dry. In 1806 the tree bore ten walnuts; in 1809 upwards of fifty, and double that number in 1810: the total height of the tree was nearly 20 feet, and its circumference at the bottom one foot nine inches.

Observation.—It is plain from this paper that an early crop of fruit may be obtained from the walnut, as well as from other standard trees; if favourable situations be selected for planting them.

On the proper stock for the Moor Park Apricot; by T. A. KNIGHT, *Esq.*—*Horticultural Trans. Vol. 2, part 1.*

It is stated that the French gardeners consider stocks of different species necessary to correct the defects of different soils and varieties of fruit; and that peach trees ought in some cases to be budded on the plum, in others on the almond, and in others upon its natural stock or upon the apricot; while our gardeners, to be under all circumstances best adapted to the peach. Mr. Knight conceiving that no other advantage resulted from the use of stock of a different species from the graft, except in some cases rendering it more dwarfish and governable, engaged in a series of experiments, with the view of ascertaining the advantages or disadvantages of stocks of different species in the culture of the peach, the nectarine, and the apricot. The following circumstance occured in the progress of his experiments. A single plant of the *Moor Park* apricot, obtained sixteen or seventeen years before by grafting upon an apricot stock, retains a smooth and polished surface, and the old tree presents a perfect degree of health and vigour; while the other Moor Park apricots in the garden, like those in most others, become in a few years diseased and debilitated, and exhibit in spaces near the head of the stock, lifeless alburnum, beneath a rough bark. So different was the appearance of the Moor Park on the apricot stock from all other trees of the same kind in the garden, that the writer found it difficult to convince gardeners of its specific identity.

Observations.—This statement proves that however right the English gardeners may be in their general principle of grafting, that at least the Moor Park apricot offers one unquestionable exception; and it is to be hoped that nurserymen will raise apricots in this manner for sale; for though it is their interest that the trees they sell should stand in need of renovation in a few years, yet an additional price for each may afford a fair compensation, even if the actual number of trees they sell should suffer diminution.

On the good effects of watering the frozen branches of Peach and Nectarine Trees very early in the morning; by G. H. NOEHDEN.—*Horticultural Trans. Vol. 2, part 1.*

THIS method was resorted to in the garden of James Stuart Wortley, Esq. near Sheffield, in order to counteract the effects of spring-frosts. The garden lies very high above the level of the sea, and is consequently without the advantage of a sheltered

situation, but the local position is not otherwise unfavorable, as it slopes a little to the eastward on the side of a high hill. Though much of the produce of this superior garden is attributed to the attentive pruning, yet Mr. Wortley was equally fortunate in the preservation of his peaches and nectarines in 1810 and 1811, when that kind of fruit was entirely destroyed by the frost in the neighbouring gardens. The gardener applied cold water at the time of the blooming and setting of the fruit in the following manner :—" if upon visiting the trees before the sun is up in the morning, after a frosty night, he finds that there is any appearance of frost in the bloom or young fruit, he waters the bloom or young fruit thoroughly with cold water, from the garden engine, and even if the blossoms and young fruit are discolored, this operation recovers them provided it be done before the suns comes upon them : and he has sometimes occasion to water particular parts of the trees more than once in the same morning before he can get entirely rid of the effects of the frost." This method was first discovered by an accident, watering cabbage-plants among some rows of kidney beans, early in a frosty morning, part of the water was spilled on the beans; and those beans were found immediately to recover the effect of the frost. The extent of wall on which the fruit was in this manner successfully preserved was 172 yards.

Observations.—This method of removing the destructive effects of frost from the blossoms of the more tender kinds of fruit is perfectly analogous to the condition of a frost-bitten joint or limb, which is recovered by the application of cold water, but injured and not unfrequently destroyed by being brought near a fire, or the influence of sudden warmth. The same means would preserve from destruction all frozen vegetable productions whatever.

On an Insect, which is occasionally very injurious to Fruit Trees; by WILLIAM SPENCE, *Esq.*

Horticultural Transactions, Vol. 2, part 1.

THE attention of this gentleman was first directed to this insect by his observing small masses of saw-dust like excrement, the the usual indication of the presence of larvæ, protruding from the edges of a cankered part of a diseased apple tree : on cutting off a portion of the wood many small white larvæ were found inhabiting cavities, which they had excavated between the bark and alburnum, upon the latter of which they seemed to feed : these were of different sizes, and when detached and placed under a

glass, they in few days produced a small moth, called *Tortrix Wœbuana*. Narrower examination shewed their ravages not to be confined to the diseased parts of the tree, nor yet to the apple tree alone. As he was more anxious to obtain a knowledge of the economy of this injurious insect than to destroy it, in the first instance, he took no steps to destroy them, but suffered them to increase. This communication to the Society affords a more complete account of the economy of this insect, than is to be found in any other British or foreign publication, but which our limits compel us to pass over. With regard to the best mode of destroying these insects, imperfect hints only are offered. The most essential process is held to be the cutting away the edges of the cankers where they are found, making smooth the wound, and covering it with a composition likely to prevent the moth from depositing her eggs there again; and it is stated to be a necessary precaution to put into boiling water or bury at a considerable depth, the pieces of decayed bark which have been cut out, otherwise the larvæ would soon crawl from their holes and remount the tree.

Observations.—The naturalist is under considerable obligations to Mr. Spence for his very explicit account of the economy of an insect so little known, though so generally destructive in gardens, as the *Tortrix Wœbuana*. The precaution of destroying the insect as well as removing it from the tree it has injured, should be equally applied to all destructive insects found among fruit trees.

On the early puberty of the Peach Tree; by T. A. KNIGHT, *Esq. Horticultural Transactions, Vol.* 2, *part* 1.

IT having been asserted by a gentleman who held an official situation in New South Wales that a seedling peach tree had produced fruit in that climate at sixteen months old without grafting; and Mr. Knight having observed that such trees continued to grow in his own garden as long as the weather continued favourable, and their leaves to assume a more perfect character in almost every succeeding month; he thought it not improbable that with the aid of glass and artificial heat he might succeed in obtaining fruit from trees of two years old, and not impossible that, by a particular mode of pruning, he might obtain it from yearling trees. The seeds destined for the experiment were subjected to the influence of artificial heat in the middle of February, and the plants appeared above the soil early in March, and were kept under

glass during the whole summer and autumn, but without any artificial heat after the end of May. As many lateral shoots were suffered to remain upon the plant as could present their foliage to the light, and these were shortened while very young to the fourth or fifth leaf, and the buds in the axillæ of these leaves were destroyed as soon as they became visible, so that none of the sap generated by these leaves might be uselessly expended: the pots were filled with the green turf of a rich meadow which had been overflowed, and were thrice changed during the summer, and new portions of the living turf added at the same time. The summer proving cold and cloudy all hope of success was relinquished for that year, and artificial heat in autumn was not applied; yet late in the autumn three of the seven plants unexpectedly formed blossom-buds, and these buds presented so vigorous and healthy a character as to leave no doubt of their being capable of producing fruit.

Observations.—This experiment shews how much may be effected by judicious training, which enables the gardener to accomplish many objects in a shorter space of time than would be otherwise required. The bearing of the peach tree may be always actuated by shortening the lateral branches.

Directions for covering the soil in Hot-beds and Pineries; and on the proper time for sowing small Seeds; by Mr. HENDERSON, *Brechen Castle.*

Memoirs of the Caledonian Horticul. Soc. Vol 1. *part* 2.

THE advantages resulting from covering the beds of hot-houses and pineries with fine drifted river or sea sand, three inches deep, are stated to be,—extirpating the *Slater* or wood-louse, the nature of the sand preventing this insect from concealing itself from the rays of the sun;—keeping down the steam from the rays of the sun;—keeping down the steam in dung hot-beds;—and affording to the fruit as warm and dry a bed as tiles or slates. This covering also retains the moisture in the beds longer than any other, and is itself sooner dry, and always gives the house a clean and neat appearance, and will be found a great preventive of that alarming evil, the mildew.

The remainder of the paper relates to the most proper time for sowing the small seeds of both flowers and shrubs; which is recommended to be done at such times as the insects that feed on them do not produce their young from the eggs and chrysalides of the former year. Attention to this circumstance is thought

of more importance to securing a crop than any particular mode of culture whatever.

Observations.—The direction for covering the beds in hot-houses with fine sand is among the most valuable improvements in garden management of the present day. And as different insects are hatched at different periods, it will be advantageous to prevent any seed from vegetating at the precise time its enemy is prepared to destroy it.

Observations on the culture of Onions, and particularly on the advantages to be derived from transplanting them from a seed bed into regular rows at a proper distance from each other; by Mr. JAMES MACDONALD.

Mem. of Caledonian Horticultural Soc. Vol. 1, *part* 1.

THE method of raising onions recommended in this paper is not merely speculative, but has been adopted by the writer with manifest advantage for four successive years: during which time it not only produced excellent onions, but likewise effectually prevented any destruction of the root either by worms or by the rot. The seed was sown in the end of February, and in April the beds for receiving the transplanted roots were made four feet and a half wide, and were divided by six drills at equal distances: the roots of the young onion plants taken from the seed bed were dipped in a thin mixture made with one part of soot and three parts of earth mixed with a sufficient quantity of water, and they were then immediately transplanted into the drills at the distance of four or five inches from each other. Nothing farther is afterwards wanting but proper hoeing to keep the bed free from weeds, which seems also greatly to promote the growth of the onions. Crops thus treated greatly exceed in August and September the size of those left in the seed bed.

Observation.—This mode of cultivating onions, like many other things in gardening, requires only practice and perseverance, to make its advantages obvious to every one: where once adopted, it will never be again relinquished.

Method of preserving Apples and Pears; by Mr. JAMES STEWART, *at Pinkie.*

Mem. of Caledonian Horticultural Soc. Vol. 1, *part* 2.

THE fruit is to be gathered when it begins to drop off spontaneously; and in plucking it the rule to be observed is, to take what appears ripest in the hand and raise it level with the foot-

stalk, and if it parts from the tree, to lay it carefully into the basket, otherwise to let it remain. In the fruitery the fruit is to be laid in heaps, and covered with clean cloths and mats, in order to its sweating, which is generally effected in three or four days. They may remain in the sweat three or four days more, and are then to be wiped separately with clean cloths. Some glazed earthen jars with covers are to be provided, and some pure pit sand, which has been well dried on a flue. A layer of sand an inch thick is to be put at the bottom of the jar, and then a layer of fruit, a quarter of inch free of each other; and then a layer of sand and fruit alternately till it be full: the jars are to be closed, and kept in a dry cold place, but free from frost. When fruit is wanted a jar may be unpacked, and that part which is ripe may be sent to the fruit room, and the remainder repacked as before. By this mode some fruit will be preserved till June or July.

Observations.—This is certainly the best of all modes of preserving apples and pears, and the trouble it occasions will be amply compensated by the possession of fruit at seasons when it cannot be otherwise obtained.

On destroying Wasps; by Mr. JOHN MITCHEL.—*Mem. of Caledonian Horticultural Soc. Vol.* 1, *part* 2.

On destroying the Green Fly;—by Mr. WILLIAM BEATTIE. *Mem. of Caledonian Horticultural Soc. Vol.* 1, *part* 2.

THE method taken by Mr. Mitchell to destroy wasps is to find out their nests, by observing in a quiet day the course of their flight from the garden, and following them till it be ascertained; and when the place is marked, he goes in the evening provided with a candle and lanthorn, and a match of damped gunpowder made in a roll on the end of a small piece of wood: he lights the gunpowder, which burns like a squib, and introduces it into the hole, putting his foot on it for a few minutes; he then digs till he sees the works, and having a pail of water ready, he throws it on them, and works it altogether like mortar. When the nest happens to be on a bush or tree, he holds the match below it, when the wasps soon fall stupified to the ground and are destroyed in the same manner. He has destroyed in this way more than fifty nests without getting a sting or passing a single wasp.

To destroy green flies Mr. Beattie puts a peck of lime into a hogshead of water, and drawing off the liquor after it has stood twenty-four hours, puts to it half a pound of common soda; and

he says that twice or thrice watering the trees with this liquor will destroy these vermin.—Mr. Mitchell entices them into bottles by means of jam or jelly.

Observations.—This mode of destroying wasps is a very good one, and we prefer taking green flies by jelly; for if the specified quantity of soda be exceeded, it will destroy the leaves, as well as the flies.

On the causes of Canker in Fruit Trees; by Mr. JAMES SMITH, *of Glasgow.*
Mem. of Caledonian Horticultural Soc. Vol. 1, *part* 3.

On the origin of Canker in Fruit Trees; by Mr. ED. SANG.
Mem. of Caledonian Horticultural Soc. Vol 1, *part* 3.

On destroying Insects, and removing Mildew, and Canker in Fruit Trees; by Mr. DAVID WEIGHTON.
Mem. of Caledonian Horticultural Soc. Vol. 1, *part* 2.

On destroying Mildew, &c.; by Mr. JOHN KYLE.
Mem. of Caledonian Horticultural Soc. Vol. 1, *part* 2.

On Canker in Fruit Trees, by JAMES SMITH, *of Ormiston.*
Mem. of Caledonian Horticultural Soc. Vol. 1, *part* 2.

THE delay which has occured in this publication has enabled us to give these papers in a more natural order than that in which they were published, and to speak of the *cause* of the disease before the means of removing it.

Mr. Smith, having imbibed the generally received opinion that canker proceeded from the roots having got into a bad soil, determined to satisfy himself as to its accuracy: and accordingly in January 1810, uncovered the roots of several of his worst infected trees in order to cut any of them that had got down into the bad soil. On uncovering the first he found that a floor of bricks of abont nine feet diameter had been laid two feet and a half below the surface: he followed each root out to the extremity, and found that none of them had ever touched the subsoil: the rest of the cankered trees were examined with precisely the same result. The wall trees were all in a healthy state, none of them having the appearance of the canker: in February 1811 Mr. Smith trenched the border, and examined the roots of every one of them, and found the roots of the greater number had penetrated into the bad subsoil, as no flooring had been laid for them. He was now convinced that canker proceeded from some other cause than a bad soil; and conjecturing it might proceed from frost, he

referred himself also to an experiment on this point. In May 1811, he marked with a thread several shoots which had been frost-bitten, and some buds which had not begun to push; and on examining the trees in the subsequent winter he found that none of the shoots made from the buds which had not began to push were in the least inclined to canker, while the greatest part, though not the whole, of the others were cankered.

Mr. Sang notices the various opinions which have prevailed as to the causes of canker in fruit trees, and particularly the theories of Mr. Forsyth, and Mr. Knight, but is not satisfied with any of them, though he thinks Mr. Knight's conjecture that it proceeds from the debility necessarily attendant on the old age of the original plant entitled to much attention, since nothing can be more plausible; but he himself rather inclines to the opinion that canker is the effect of a vitiated habit, and that whenever it appears the whole of the juices of the plant are in a vitiated state. Another train of reflection was however suggested by observing a bed of crab-stocks sown on a moist sandy soil upheld by a bed of rotten rock, some of which at two years old were so much cankered as to be unfit for grafting; and of the apparently healthy plants many afterwards used became cankered, though grafted with kinds remarkably healthy.

Mr. Weighton, after enumerating the various species of insects which are injurious to fruit trees, observes that the mildew does more injury than all of them; he admits his ignorance whether it proceeds from he soil or from the air, or whether it be an insect or fungus; it may however he says, be kept under (he cannot add cured) by washing trees affected by it with a mixture of sulphur and lime water. He conceives that the *canker* in fruit trees may be prevented by proper care, particularly by limiting the head to such a proportion that the roots may properly afford nourishment, and by cutting out the infected places, and covering the wound with paint. He has remarked the tender kinds of fruit trees to be most subject to canker, and has observed a standard tree, that was full of this disease, to be cured by removing it to a south wall. He recommends planting the hardier trees in the most exposed situations, and the tender ones where they are sheltered, and thinks this attention the best preventive of canker.

Mr. Kyle states the *mildew* on peach trees to be occasioned by a very destructive insect; and that he tried several ways, but could not yet get clear of it, till he watered the borders with cow-urine, and for nine and ten years he has not had the least appearance of it. He gives a watering with this liquor at the winter dressing in the November or December, and again when the trees begin to shoot in the spring. He likewise does the same to the vines, and never misses a good crop.

Mr. Smith of Ormiston, the gardener to the Earl of Hopetown, submits (in the last of the papers under notice) many observations on the pernicious effects of procuring scions for grafting in a promiscuous manner, on the effects of soils, and on the effects of injudicious pruning and accidental wounds: and in discussing these he points out the circumstances which in his practise have led to the canker, and the modes by which the evil has been removed, or alleviated. To follow him through every part of his long communication would be in fact to transcribe the whole, the best means of avoiding the evil he conceives to consist in selecting healthy scions and stocks for grafting, adapting the soil and situation to the nature of the trees, pruning in a judicious manner, paying the proper attention to accidental wounds, and keeping the trees free from insects.

Observations.—The subject of these papers is equally interesting to the English as to the Scottish gardener; the rules laid down for the raising and management of fruit trees (particular in the last paper) are highly deserving of attention, and a due observance of them will almost ensure success.

Account of the culture of Sea-Cale; by H. B. Way, *Esq. of Bridport.—Trans. Soc. of Arts, Vol. 29.*

The best mode of cultivating sea cale is considered to be to draw lines in a very dry soil and dry situation, on ground with a southern aspect, about two feet one way by about eighteen inches the other, and where the lines cross, to put in three or four good perfect seeds in a square or triangle about three inches apart; this may be done any time in November or December in open weather, and it will require no other care afterwards; but keeping the ground clear of weeds till the autumn of the following year, when all the plants but one of the finest in each square may be taken up, and will serve to form other beds set the same distance apart. The ground between the plants should be dug in the spring and fall of the year with such care as not to injure the plants; and the leaves be left till they fall off naturally which seldom happens before November; and in the autumn of the second year the same attention is required. In the third year towards the end of November, when the leaves have been cleared and the ground dug, each plant should be covered over with a tub or pan, a heap of small stones, coarse cinders, or coarse bark, raised about ten or twelve inches over the crown of each plant; and from the latter end of February to the latter end of March, the plants will be very fine and fit for use. Those that have been

bleached with sea-gravel about the size of large peas or beans, are superior to any other. The plants should be cut but once in the year, since more frequent cutting weakens them and lessens their size; but if it is not desired to have the plants very large they may be bleached and cut a year sooner. A sandy soil is found better adapted to these plants than a better soil highly manured; and they will succeed as well in poor ground as in rich provided the soil is dry, and care taken with the management. As soon as the plants are cut for use, the earth should be immediately drawn over with a trowel so as to cover the whole, which makes them shoot again more luxuriantly.

Observations.—These directions are valuable for the cultivation of a vegetable so desirable to be obtained, and so highly esteemed as an article of luxury; for they evince that it does not require the expence hitherto laid out on its culture, but may be advantageously produced on land applicable to few other purposes.

Observations on the disease in the Potatoe, generally called the Curl; pointing out the most probable method of preventing it; with an account of the results of a few Experiments made on the subject; by Mr. THOMAS DICKSON.
Member of Caledonian Horticul. Society, Vol. 1, *part* 1.

On the prevention of the disease called the Curl in the Potatoe; by T. A. KNIGHT, *Esq.*
Horticultural Transactions, Vol. 2. *part* 1.

THIS disease is said to have first prevailed about thirty-five or forty years ago, and to have been attributed to various causes at different times; some ascribing the evil to a disease in the seed stock; others thinking they had been frost-bitten in the preceding winter; some ascribing the disease to blights, others to insects or an exhausted soil: the Hon. Baron Hepburn, of Smeaton, whose knowledge in horticultural science is universally admitted, held however a different opinion, and thought that the curl was probably caused by the tubers used for seed stock having been allowed to become too ripe the preceding year, and that by this means the vegetative power ofthe tubers in time became exhausted. Amidst his doubts on this subject he resolved on making a course of experiments in order to obtain satisfaction, and personally superintended them throughout. Assuming therefore the principal cause of the curl to be the exhausted state of the tubers from repeated over ripening of those used for propagation, he selected in the year 1800 about a peck of long flat potatoes, and took two sets

from each end; two being taken from the extreme end of the tuber, which he calls the *dry* end, and two from the end adhering to the root, which he calls the *wet* end, and which were ripened much less perfectly than the sets taken from the other extremity: each sort was planted upon the same ground but in different rows, with the same kind and quantity of manure to each. At the latter end of April 1801, the season was favourable. In the end of June the plants from the *wet*, or least ripened of the potatoe, had come up and appeared healthy, but of the sets from the other, or *dry* end, few have appeared above ground, and these were all more or less diseased, nor did they when taken up, shew signs of vegetation, but remained fresh and inert as when planted; neither did they change their appearance throughout the season. In the end of July another examination was made; the plants from the unripe sets were then almost covering the ground, though planted at two feet distances, and were remarkably free from curl, while those ripened sets, which had vegetated had made but little progress, and were curled universally, several of the plants dying from mere weakness, and such as grew stronger having but few and those very small tubers at the roots. The same course of experiments was repeated the two following years and the results were exactly similar, the plants produced from the unripened ends continuing healthy, and producing abundant crops, which those produced from the dry ends continued to degenerate. These results satisfied Mr. Dickson that the disease originated entirely in the over ripening of the seed stocks, and he adds that subsequent trials have confirmed the opinion. He recommends, as the most effectual means of removing the curl from potatoe crop, ---to procure sound healthy stock from a high situation where from the climate the tubers are not over ripened;—to plant such potatoes, as are intended to supply seed stock the ensuing season, at least a fortnight later than those planted for use, and to take them up whenever the stems become of a yellow green colour;—and to prevent those plants from producing seeds or flowers by cutting off the extreme tops whenever flowers begin to appear.

Mr. Knight, in a paper read to the London Horticultural Society, subsequently to the publication of the preceding, withholds his assent from the theory of Mr. Dickson, as to the cause of the disease in question; and declares himself to remain of the opinion he had held in 1810, that the rough or crumpled state of the leaf probably originates in the preternaturally inspissated state of the fluid in the firm and farinaceous potatoe: Mr. Knight doubts very much whether the potatoe, which is a native of Virginia in America, can ever be too much ripened in the northern climate of Scotland.

Observations.—While two such able and intelligent horticulturists as Mr. Knight and Mr. Dickson, hold different opinions on the cause of the curl in potatoes, we may justifiably retain our own doubts on the subject: but the practical advantages resulting from Mr. Dicksons method of planting and managing his potatoes designed for seed stock will recommend it even to the practice of those who reject his theory of the cause of this destructive disease.

On the growth of Mulberry Trees; by Mr. CHARLES HALL, *Agric. Mag. Vol.* 1, *No.* 6.

IN consequence of a difficulty having been felt in Devonshire for a supply of silk for the silk machines there, Mr. Hall communicated his observations on the propriety of planting mulberry trees, for the purpose of raising silk-worms in this country. He states that there are three species of the mulberry, which might be cultivated with success in England, the *rubra*, the *alba*, and the *nigra*; as they are all hardy, and will succeed in any soil or situation; the leaves of the *alba* or *white mulberry* are however the best for feeding silk worms. All these species admit of propagation by the shoots, which have taken root, by seed, by layers, or by slips. A peculiar method is described, by which mulberry trees are raised in France, and which has been repeated with success in the East Indies: the ripe berries of the mulberry are taken when they are full of juice and seeds, and rubbed with the hand along a rough horse hair line, such as is used for the drying of clothes, bruising and mashing the berries as much as possible, so that the pulp and seeds may adhere in great abundance to the line; which is then cut into lengths and laid in a trench dug in the ground, and covered well over with earth, and great care is taken to keep the ground moist by watering, as this is essential for the growth of the seeds, which will then soon shoot out young suckers, and bear young leaves. And young leaves are said to be the preferable food for silk worms when they can be had, though the worms will feed on dried leaves, which should always be preserved in the preceding autumn, lest in this climate the eggs should be hatched before the young leaves appear in the spring.

Observations.—When it is remembered how much pains the great Catharine of Russia took to raise mulberry trees in the Crisna, that her kingdom might not be dependent on Persia for a supply of silk, there cannot remain a doubt of the importance to Britain of also placing her silk manufactories independent of the importation of the raw silk from other countries.